ENGINEERING AND MINING JOURNAL

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MARCH 1958

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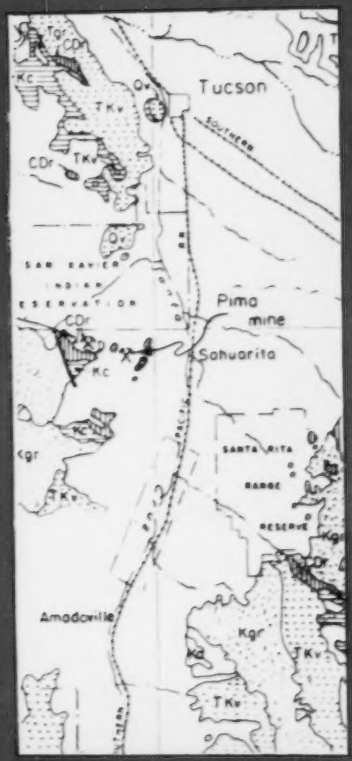

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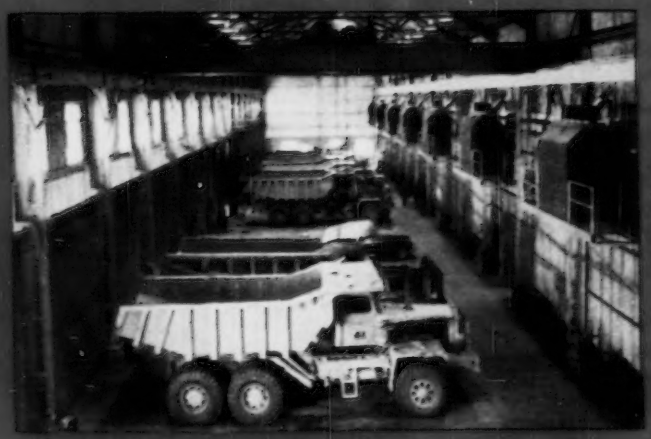

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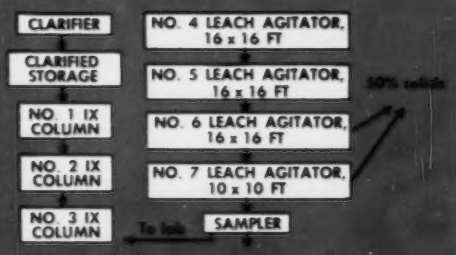
CLARIFIER
CLARIFIED STORAGE
NO. 1 IX COLUMN
NO. 2 IX COLUMN
NO. 3 IX COLUMN
NO. 4 LEACH AGITATOR, 16 x 16 FT
NO. 5 LEACH AGITATOR, 16 x 16 FT
NO. 6 LEACH AGITATOR, 16 x 16 FT
NO. 7 LEACH AGITATOR, 10 x 10 FT
50% solids
To tails
SAMPLER

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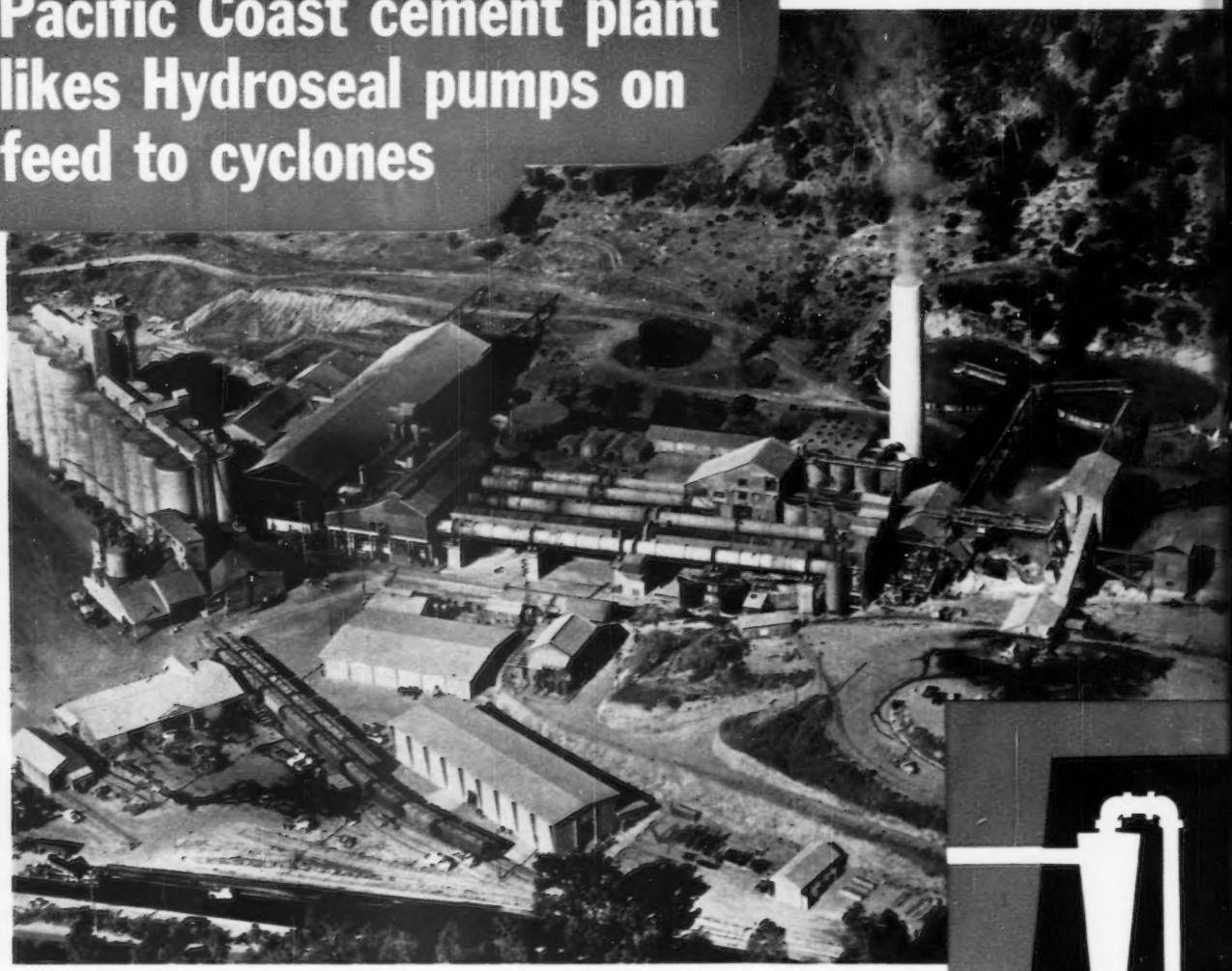
Pacific Coast cement plant likes Hydroseal pumps on feed to cyclones



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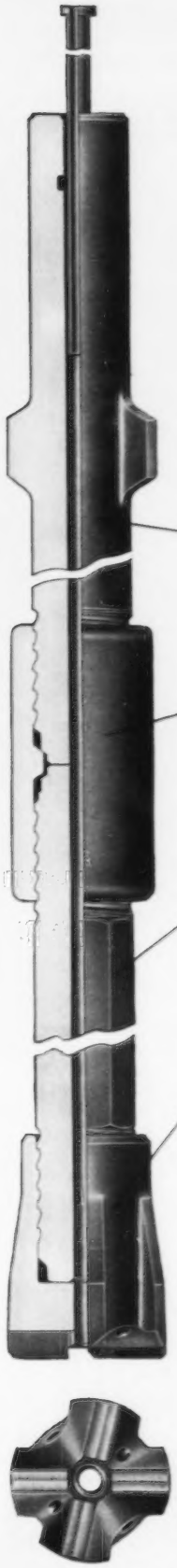

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ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

MARCH 1958

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B.F.Goodrich

Photo courtesy Left Fork Fuel Co., Quinwood, W. Va.

Rubber jumps a mile-long mud puddle

B. F. Goodrich improvements in rubber brought extra savings

Problem: At this West Virginia coal mine it was impossible to get coal to the railway spurs in bad weather. Roads became impassable, trucks bogged down in the mud. Rain or snow brought the mine's daily coal production to a stop.

What was done: Engineers recommended that the coal be carried almost a mile to the railway spur by a series of four B.F.Goodrich conveyor belts. Two of the belts in the series had to be extra-strong, so B.F.Goodrich Nyfil cord belts were installed. Unlike other conveyor belts, made of rubber and layers of fabric, the B.F.Goodrich Nyfil cord belt is made with cords, running lengthwise, buried in the rubber. The cords add so much strength that a single belt can now travel distances and carry loads once considered impossible.

Savings: The four B.F.Goodrich belts used in the conveyor system have now given over 5 years of trouble-free service, hauling 1000 tons every 16-hour working day.

Extra benefits: All B.F.Goodrich belts have other improvements, too, brought by better manufacturing methods—such as making belts under uniform tension, so that all fibers work together; seamless plies to avoid weak spots; cushioned edges for longer wear; patented layers called "breakers" to stand hard blows; mildew treatment to protect fabric. All these improvements and many others help cut costs through better performance.

Where to buy: Your B.F.Goodrich distributor has full information on the conveyor belts described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-294, Akron 18, Ohio.*

B.F.Goodrich industrial products

Behind the By-Lines...

Thank heavens for Our Mr. Huttl! What with Christmas poems and shopping, and post-Christmas exchanging, and then New Year's (never mind what about New Year's!), and then the February issue, we've had to put off a great deal of our regular worrying.

This month, thanks to OMH, we're beginning to catch up. Our peerless San Francisco editor has been traveling and visiting and grinding out copy to beat the band and we're happy to serve it up herewith.

South of Tucson, as they say on the teevee, things are a-happenin'. We've taken a long look at the carryings-on at Pima Mining Co. and report in full detail on page 100. A smooth operation and a highly efficient and hospitable staff made the jaunt one of his most memorable, says Our Mr. H., and he recommends most highly the discussions of the property by staff members at the AIME convention, to be published some time soon by the Mining Society.

Pima was almost too much of a good thing, so we've made a separate article out of one part of the story. On page 98 you'll find the story of the rockover skip system at the mine. It's simplified haulage in a difficult pit, and well worth the reading.

As further proof that Our Mr. Huttl is your boy, he's been out looking for the sort of story that's most needed in these tightened times. On page 110 he discusses how maintenance was improved at the Berkeley Pit at Butte. And it's not just a story of equipment and inventory.

But to get to that worrying. Most important on the agenda is the righting of what can only be characterized as a grievous wrong. Our friend Bob Bernick of the Salt Lake *Tribune* has informed us that the Consolidated Coppermines pit (now Kennecott's) at Kimberly, Nev., was the scene of a great miscarriage of justice and misplacement of credit. The pit (see page 22) was discovered by a Montana prospector named Giroux. He was pretty happy about it.

Enter, from stage right, Nemesis. The new postmaster for the thriving community had to tell the boys back at headquarters what the town was called. So he did. And he signed his name to the message. And his name was Kimberly.

If the industry lets the name of Giroux expire, then we must, regretfully, admit that we are on our way down that long road from which there is no returning.

We have several alternatives. The first, and most obvious, is to rename Kimberly. Anyone familiar with Government workings knows that that's where they'll expect us to strike. So that's out.

No, comrades, we must take the unexpected avenue. Try the sound of "Giroux Diamond Fields" on the fellow members of the cell. Or, if that doesn't work, how about renaming Chicago?

As if all this wasn't enough to take up our worrying time, we've been plunged back into the niobium-columbium controversy. DuPont has been producing, and we quote, "experimental amounts of Element 41." Okay, Element 41 is fine with us.

But our friends at Wilmington don't let it rest there. Smack in the first paragraph of their release appears the awful word—"niobium."

In August 1952 we thought we'd settled the problem, when we spotted the identification of columbium in 1801 by Prof. Charles Hatchett of England, and the subsequent discovery of the same mineral 43 years later by Heinrich Rose, who called it niobium. Rose realized his mistake, but too late. We're sure if he were around today he'd say, "Bleeze forget it, chentlemen, Herr Professor Hatchett vas corregdt, und I made a mischtake." (Rose was quite a talker. We got a recording of his voice from the archives of the South Missouri Home for the Tall, and believe us, it's pretty impressive. The man had a conviction that comes right across to you. What the French call *timbre.*)

In these days of unrest and disquietude, we feel that each and every citizen needs one (at least, one) firm conviction. Ours is that the mineral discovered by Hatchett in 1801 is columbium.

And this need not cause a rift. If duPont, and the International Union of Pure and Applied Chemistry, and the American Chemical Society, and the National Science Foundation, and most of our European friends want to call it n - - - - - m, that's okay with us.

After all, this publication has gotten along for more than 92 years with some mining engineers who spell program as programme; who call levels—horizons; projects—schemes; harbors—harbours; and hoists—winders. What's one more conflict among the English Speaking Peoples?

And besides, Columbus has already suffered enough at the hands of johnny-come-latelies. Didn't Signor A. Vespucci pull a Kimberly on him? Tell us, International Union of Pure and Applied Chemistry—what did Niobus ever discover?

There's a unique combination of before-and-after starting on page 90. Last July, because we'd never had a good look at a column ion exchange plant before it was in operation, publisher Carl Coash and editor Al Knoerr took a trip up to Newmont's Dawn Uranium mill at Ford, Wash. There they had a pleasant and instructive visit with Bob Fulton and the staff. Subsequently, we learned that assistant manager Don Hargrove was going to present a paper at the Northwest Mining Association, giving operating data and production results, in December.

You won't see any yellow cake coming out of the equipment pictured in the story. But, in the text, Brother Hargrove tells you all about it, and how it's going through now. Some of the pics are pretty exciting, and some, like the pipefitter's nightmare, pretty confusing. Hope you enjoy it.

Incidentally, if there's a mill man among us who has qualms about the rapid changes in mineral processing methods, Don Hargrove has some reassuring words.

"You have to live with the circuit, of course," he says, "but then, you always have to, no matter what the process. But, for an old cyanide man (and Hargrove is one) the transition isn't too tough."

We realize that we've been belaboring the Signs-For-Home-And-Office routine, but there's one more, from Wolverine Tube, that cries to be passed on—"I feel more like I do now than I did when I came in."

Why the rugged Caterpillar No. 12 is a key machine on any team!

With a long-standing reputation as the "machine that stays full time on the tough jobs," the dependable CAT No. 12 Motor Grader is easy to operate and economical to own. The No. 12 shown here is a key machine because it keeps hauling equipment rolling by maintaining haul roads on mining operations near Schefferville, Quebec. Here Iron Ore Co. of Canada is producing 12 million tons of ore per year from four groups of pits.

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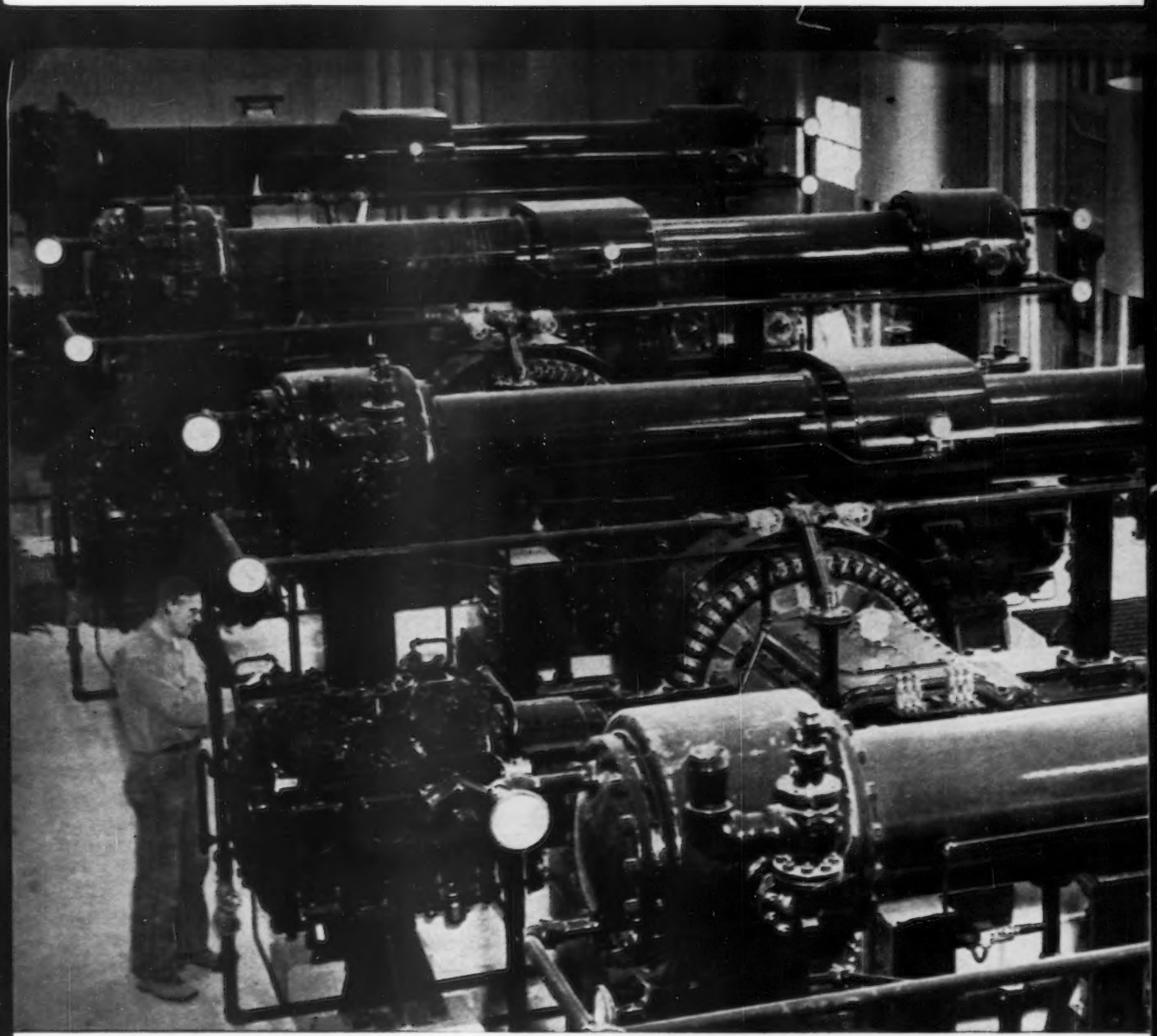
THE MACHINES THAT WORK FULL TIME



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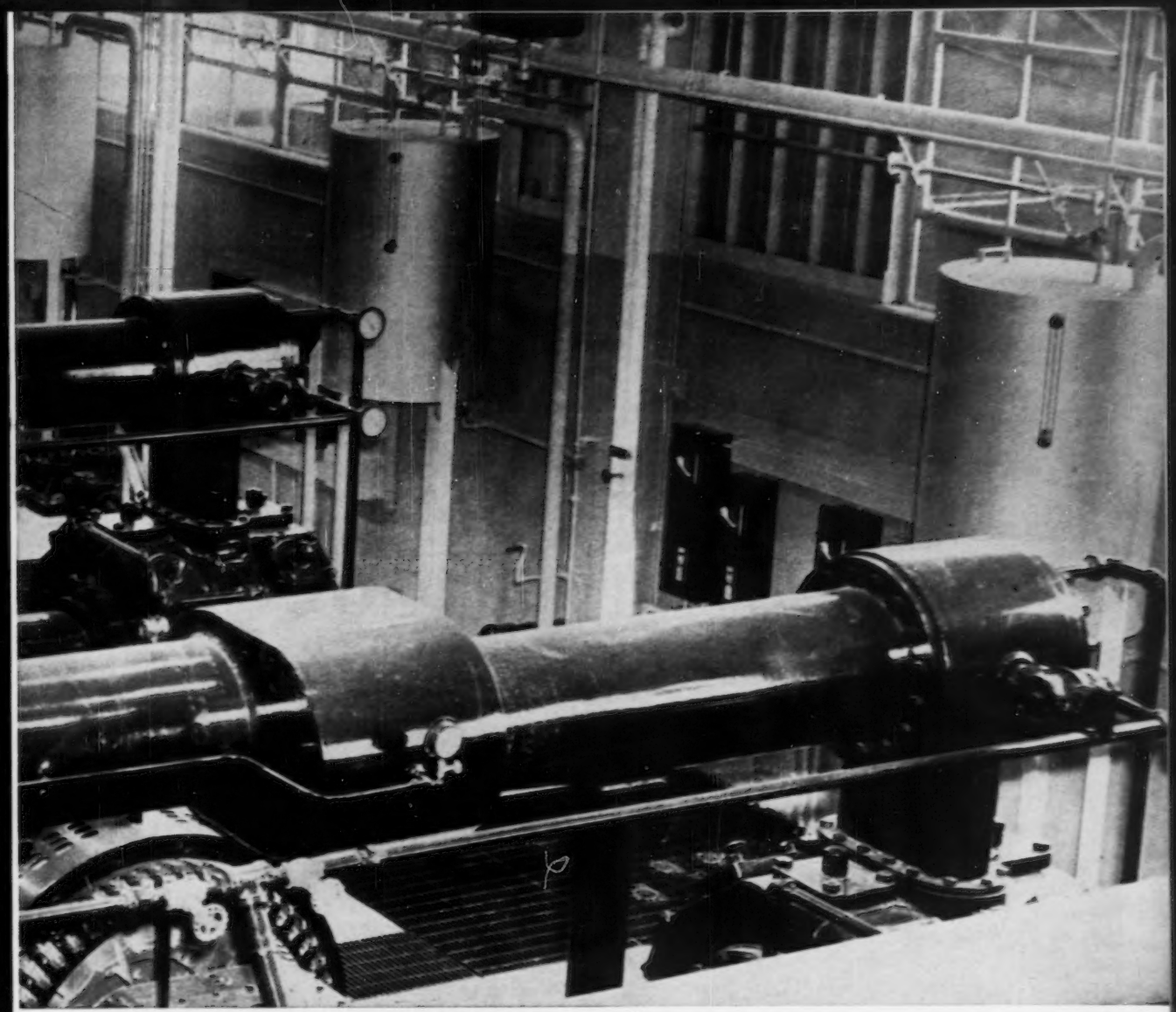

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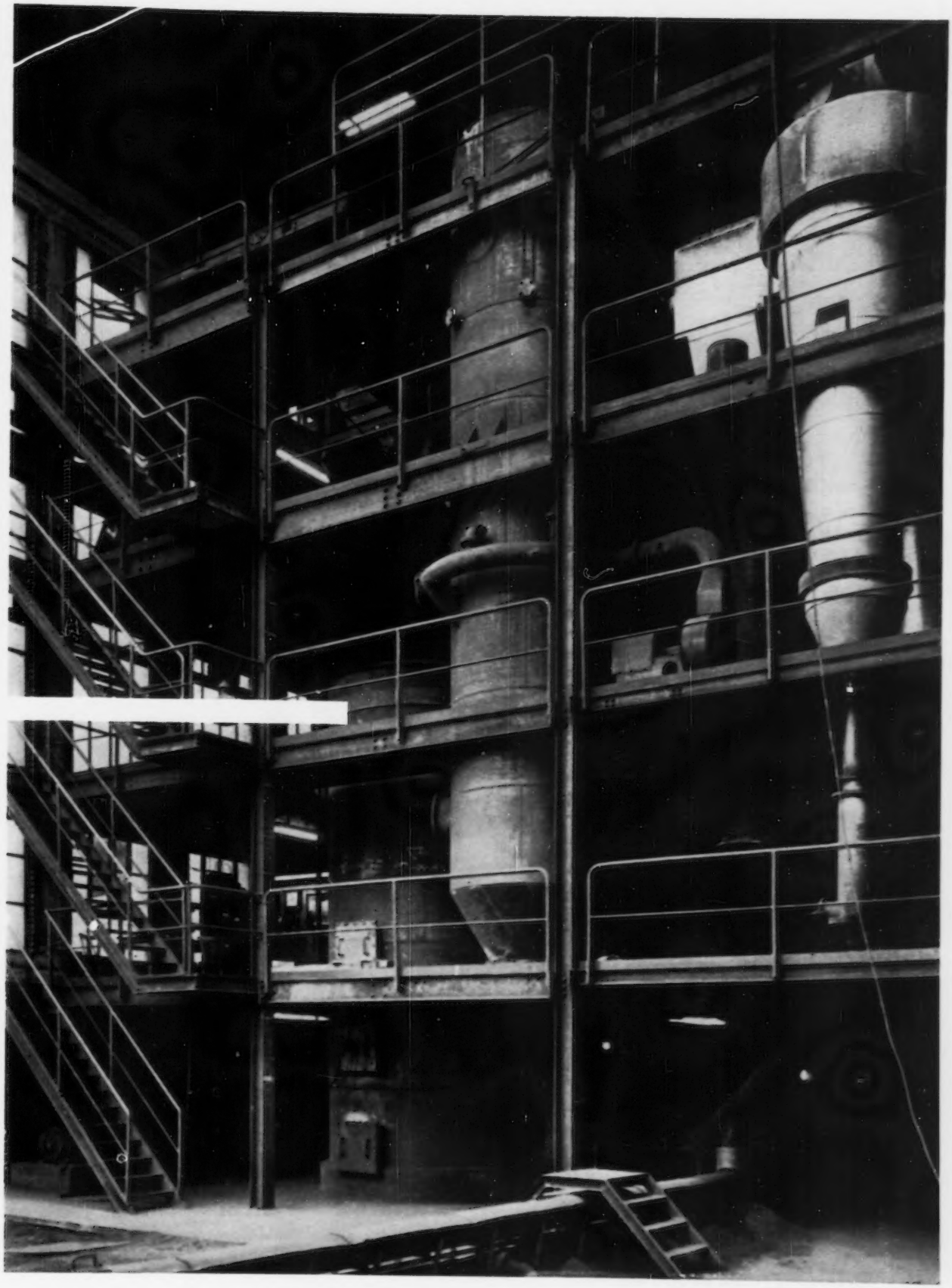
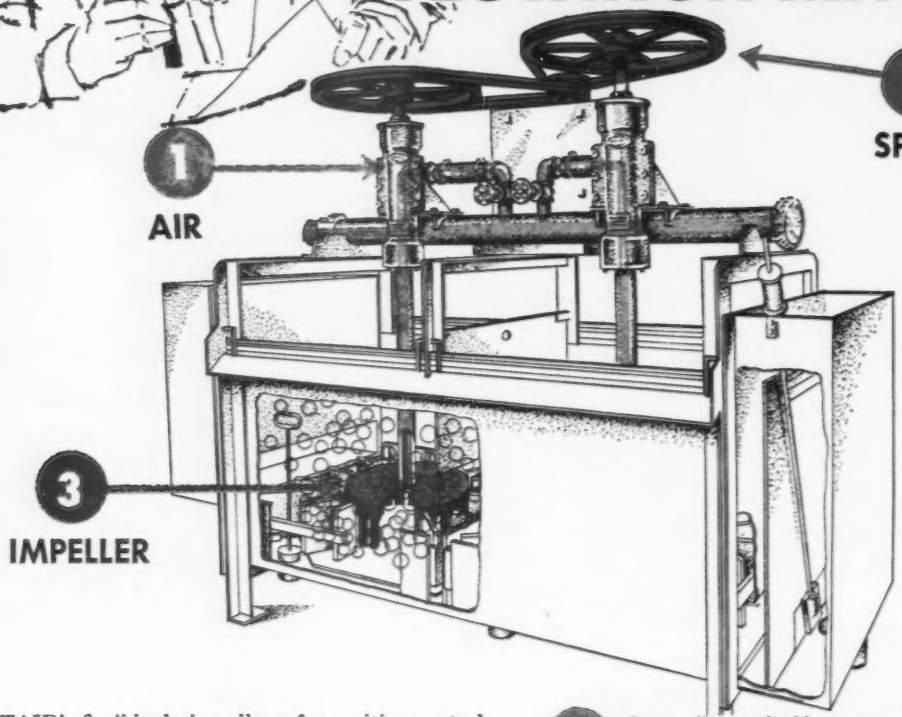


Positive control of metallurgy yields maximum profits with AGITAIR® FLOTATION MACHINE



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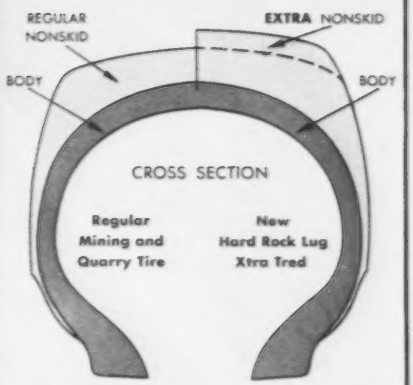

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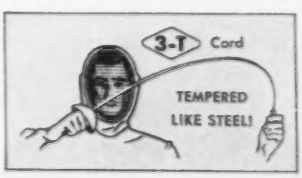
Let the new Hard Rock Lug XTRA TRED square off against your toughest tread-wear problems. It's a great, new tire–born and built to soften up the toughest going! Goodyear, Truck Tire Dept., Akron 16, Ohio.



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MINIMUM OPERATING COST—These conveyors require a minimum of power for the tonnages of materials handled. Maintenance normally consists only of lubrication.

Boosts haulage efficiency and increases safety

CROWD— that gives DIGGING POWER PLUS!

Those words "Digging Power Plus," are not just a catch phrase. They mean what they say! A Northwest Shovel *does* give you "Digging Power Plus."

The Northwest Crowd is a Dual Crowd. It is the simplest, most powerful crowding mechanism on the market today — a combination of the simple Northwest Independent Crowd *plus* an additional force for crowding that most independent crowd shovels waste.

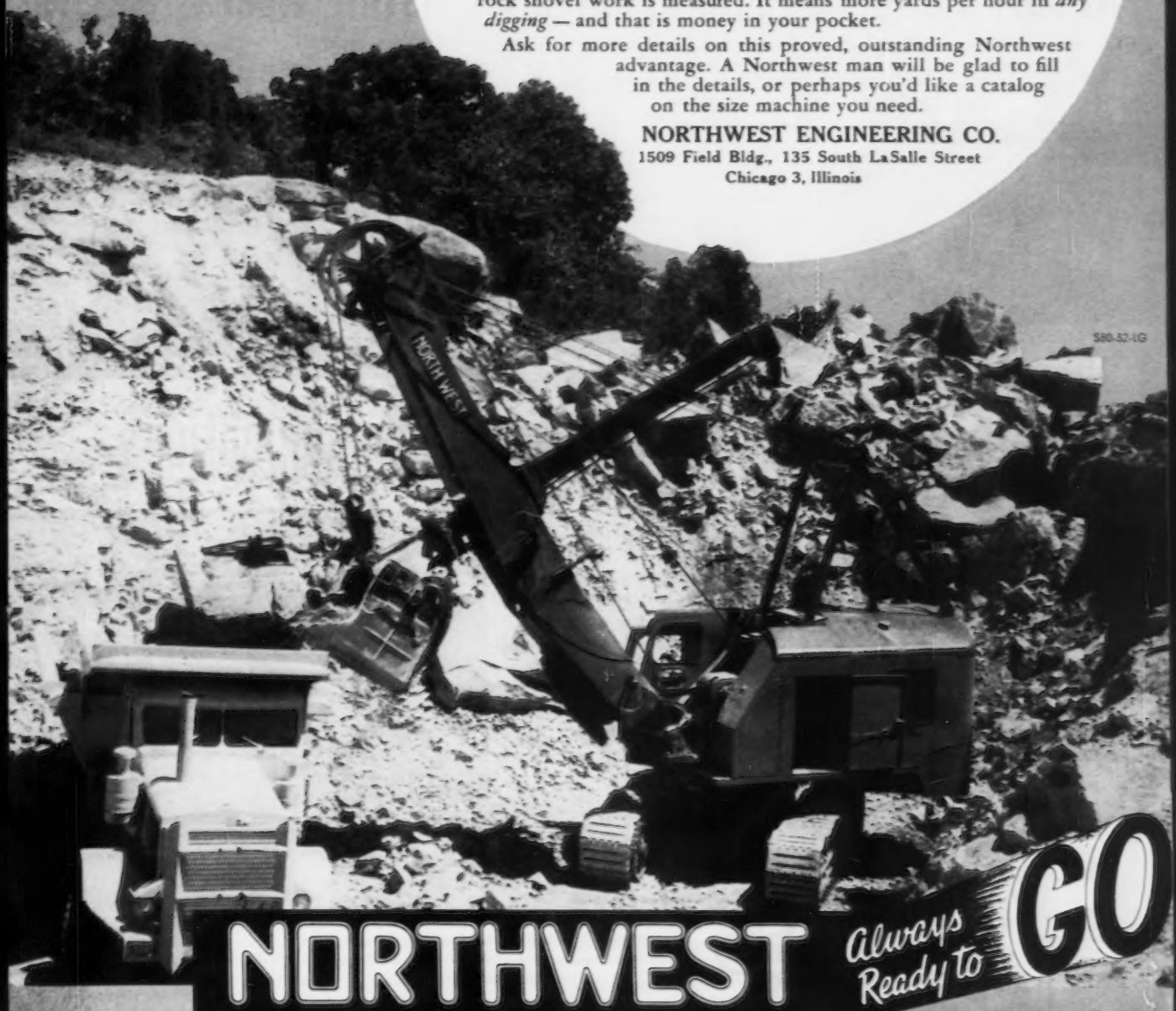
Every power shovel on the market that dead-ends the hoist cable on the boom is wasting a force equal to one-half the pull at the dipper bale.

On Northwest Shovels the tension of the Hoist Cable is added to the force of the Independent Crowd Cable, making available for digging this additional force, wasted by most independent crowd shovels. *Here is a simple, powerful crowd!*

In this additional crowding force lies a large part of Northwest ability to handle rock digging without stuttering — without delay. It is one of the features that make it a *real* Rock Shovel and the standard by which rock shovel work is measured. It means more yards per hour in *any digging* — and that is money in your pocket.

Ask for more details on this proved, outstanding Northwest advantage. A Northwest man will be glad to fill in the details, or perhaps you'd like a catalog on the size machine you need.

NORTHWEST ENGINEERING CO.
1509 Field Bldg., 135 South LaSalle Street
Chicago 3, Illinois



NORTHWEST *Always Ready to* GO

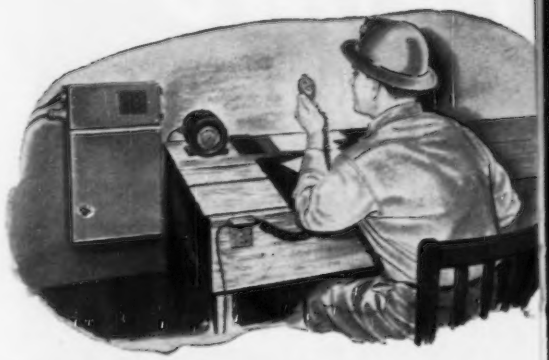
NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
⅜ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	⅜ Yd. to 3 Yd. Capacity	⅜ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

Boosts haulage efficiency and increases safety...

M·S·A MinePhone

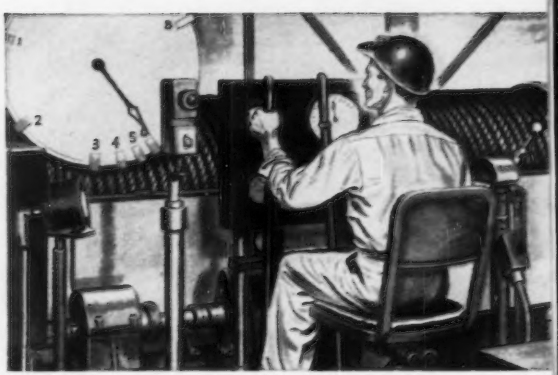
The M.S.A. MinePhone is eliminating communication delays in mines everywhere. This clear, instant two-way voice communication system coordinates the wide variety of operations vital to peak production. Haulage moves faster because dispatcher and motormen are constantly in touch, even while trips are in motion. Shop and maintenance personnel are always "on call." And because messages are relayed instantly, on an open-line hookup, underground safety is increased. Write for details.



Assures accurate, safe, speedy hoisting operations...

M·S·A HoistPhone

The M.S.A. HoistPhone provides continuous, dependable and efficient voice communication between hoisting engineer and cage, at any level, and when in motion. The system is invaluable in emergencies, yet designed for day-in-day-out service. Ideal for passenger travel, load leveling, inspection trips, and construction work, the HoistPhone requires no special training; utilizes existing wiring. Write for complete details.



Permits emergency or temporary communications...

M·S·A Portable HoistPhone

A compact, integral unit that can be set up anywhere, and put into immediate service for clear, dependable voice communications. Its light weight and ease of operation make it ideal for temporary communications for inspection work or for emergency assignments. Write for details.

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SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M.S.A. is at your service. Our job is to help you.

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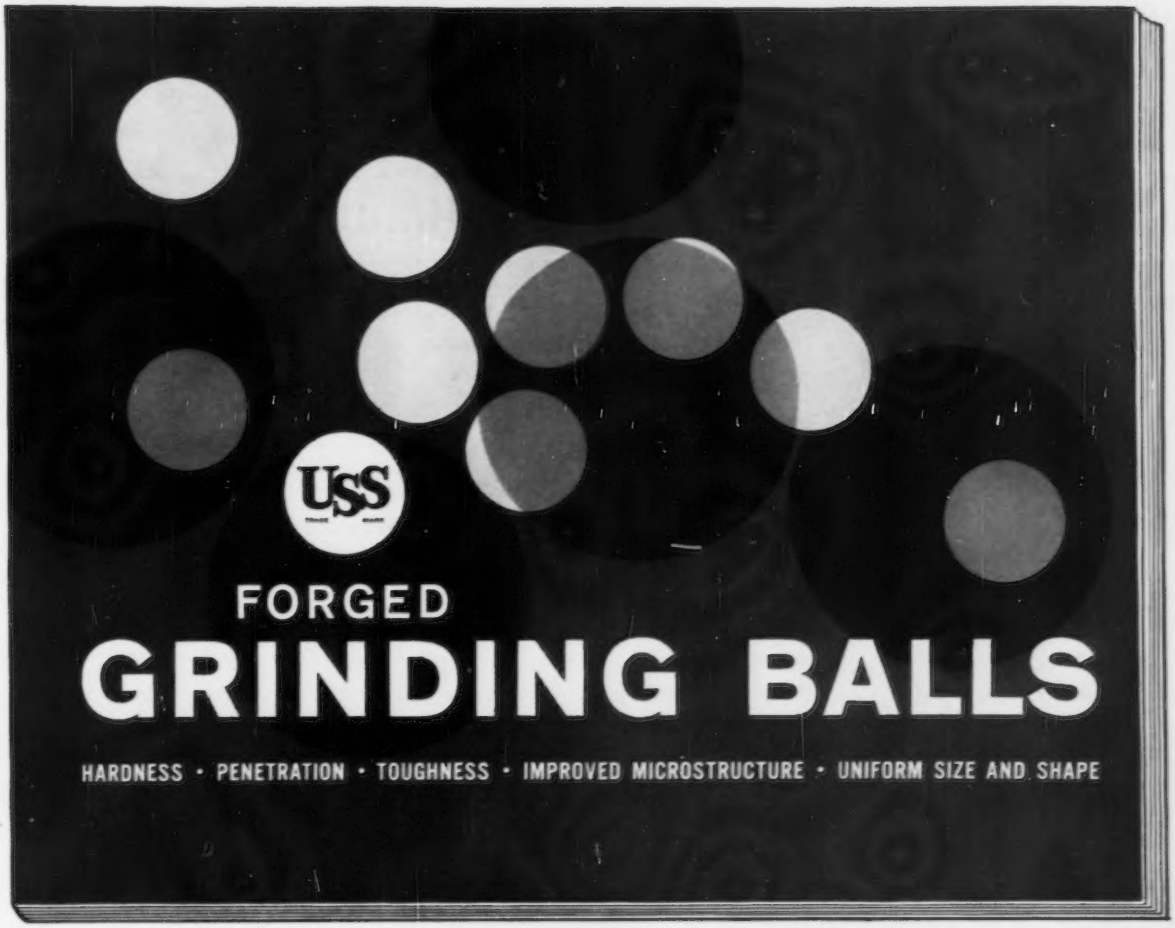
At Your Service: 77 branch offices in the United States and Mexico

MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.

Capacity Capacity Capacity Capacity Capacity



New Free Booklet shows why

USS Forged Steel Grinding Balls are your best buy!

THIS NEW 16-PAGE BOOKLET tells how USS Grinding Balls are made and what tests are applied to maintain grinding ball quality. It lists the chemical compositions of both the Carbon-Manganese and Alloy grades of USS Forged Steel Grinding Balls, pictures the modern heat-treating facilities, and charts the results of both Brinell and Rockwell hardness tests obtained from typical grinding balls before shipment from our plant.

This kind of data is only part of the information to be found in our new illustrated booklet describing USS Grinding Balls, their characteristics and manufacture. We will gladly send you a free copy. Just fill in the coupon at right.

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Name .....

Company .....

Address .....

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TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U N I T E D S T A T E S S T E E L

ENGINEER'S FIELD REPORT

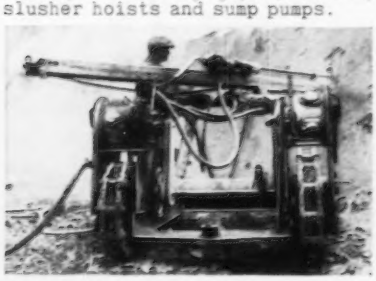
PRODUCT **CHEVRON VISTAC OIL**

FIRM **NEVADA-MASSACHUSETTS COMPANY**
Tungsten, Nevada

Special Oil holds wear to minimum for 15 yrs.

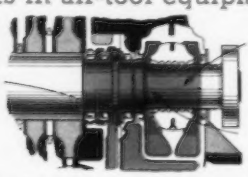
Nevada-Massachusetts Co., operators of one of the world's largest tungsten mines, has relied on Chevron Vistac Oil for 15 years, to keep their rock drills and other air tools operating at peak efficiency. "We use Vistac because it stays on the tools whether they're wet or dry. Doesn't create drag, either...we get full power with minimum tool wear," says general manager Eldridge Nash. Oil's tough, protective film resists high operating temperatures, helps this firm's rock drills (above) bore fifteen 2½-inch blasting holes averaging twelve feet in depth, in just eight hours. Nevada-Mass. does extensive underground mining at this site as well as surface operations.

Despite heavy abrasive dust from drilling in Hornfels and Scheelite, (above), Chevron Vistac Oil keeps rock drills working smoothly. Lubricant is used in 60 rock drills, 3 wagon drills, plus 25 tuggers (air motors) on hoist equipment, loaders, slusher hoists and sump pumps.



Special wagon drill, built at mine, uses Ingersoll Rand DA 35 rock drill to bore horizontal holes up to 18 ft. deep. EIMCO air motors lubricated with Chevron Vistac Oil power tracks for fast and easy maneuvering.

Why Chevron Vistac Oil cuts costs in air-tool equipment



- Atomizes quickly and completely—carries evenly over all parts. Prevents excessive fogging and has no unpleasant odor.
- Additives help form tenacious, oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss.
- Resists high temperatures and oxidation. Stays fluid at low temperatures.

For More Information on this or other petroleum products, or the name of your nearest distributor, write or call any company listed.

CHEVRON Industrial Lubricants

TRADEMARKS "CHEVRON," "VISTAC" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA,
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THE CALIFORNIA COMPANY,
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

ENGINEERING AND MINING JOURNAL

MARCH, 1958

Are Our Engineers Expendable?

JUDGING from the number of mining and metallurgical engineers who have been laid off along with the muckers in recent mine shutdowns, and from those who through the excuse of economic pressure are kept down in status and in pay until they are forced to seek more attractive fields, we'd say that too many mining companies consider the engineer expendable when quarterly earnings drop off due to low metal prices and demand.

Each time base metal prices slump (about once every three years) the number of experienced engineers contacting our offices for jobs on mining staffs rises significantly; and each time the prices soar the number of mining companies seeking experienced engineers increases noticeably.

This blow-hot-blow-cold attitude of the mining industry toward engineers is also apparent in the educational field. At the recent AIME convention several educators expressed concern over the current lack of interest in interviewing June graduates.

This is exactly what happened during the metal price slump several years ago when the college profs reported that oil companies were looking their lads over, but that not a single mining company had shown any interest.

Now, we'd like to believe that the mining industry has made some progress since the 1935-40 days when a graduate mining engineer thought nothing of "rustling" a week or two, standing in a foot of snow at 11,000 ft to get a job as a chute blaster or a mucker; or showing up each morning along with a bunch of ten-day miners for days on end to be scowled at by a "hiring King" before landing a job as a timberman's helper or trammer. In those days the engineers accepted such treatment because there was a real depression on, also because too many mines were run by hard-rock miners who didn't know how to use engineers.

But surely today, with the crying need to cut costs by pennies per ton through such new industrial engineering techniques as quality control and mine-cycle studies; and with new mineral extraction processes such as chelation, ion exchange, retarded ion exchange, multiple and compound solvent extraction, the revival of chloridized roasting, and fluidized roasting, which could knock out conventional processes of the Thirties—surely today there must be a firm place for the engineer in our mines and mineral processing plants. And by firm, we mean that a thin slice of corporate fat should be set aside as a reserve so that good engineers will not have to go "down the hill" every time base metal prices fall off a few cents a pound.

Also by "firm place" for the engineer we mean that mining companies should not have to look outside of their own staffs to fill key positions which have been vacated through retirement, or have been newly created because of expanding markets and booming prices. From the number of "management consultants" contacting our offices from time to time looking for "qualified" $30,000-a-year-and-up men to fill executive positions, it is quite apparent that the promotion-from-within policy has not been accepted by mining companies as solidly as it should be. Any other policy leads to high-level pirating, and plenty of that has taken place in our industry during the last decade.

To sum up: Let's create a firm place for the engineer in the mining industry, let's use more of them, and let's use them more effectively. Let's train them to become good managers and corporate leaders. Good engineers, properly used, are not "overhead," and certainly they should not be expendable.

MARKETS

Copper Prices Weaken; Lead and Zinc Sales Low; Other Prices Drop

NONFERROUS METAL PRICES in February dropped to 168.38% of the 1922-'24 average from 170.68. Copper and silver prices brought the index down.

Copper prices in the U.S. dropped in February. Though producers remained at 25c delivered, custom smelters dropped to 23c near the end of the month. Dealers were nearly 1c lower. Katanga dropped to 20.425c N.Y. and European ports. The London Metal Exchange was about 20.1c; premiums over this price for wire bars were about ¾c. In the U.S., No. 2 copper scrap paid by custom smelters dropped to 17.25c and brass ingot prices dropped ½c and for some types by 1c.

Copper statistics were unfavorable. Copper association figures on sales in the U.S. up to the day shown, for delivery in the month indicated and in the next following month, show February to be lower than preceding months; these had been lower than most earlier months.

	Feb. 27	Jan. 27	Dec. 27	Nov. 27
Current month ...	76,082	85,324	86,263	99,573
Following month .	21,296	13,553	19,049	27,253

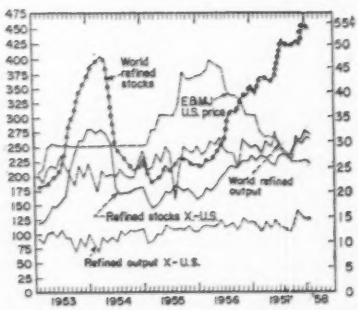
Many factors had anticipated improvement in sales figures. Copper fabricator statistics for the U.S. in January were disappointing: stocks rose about 15,000 tons to 445,514, product sales dropped to 57,561 from 92,979 tons, and unfilled orders dropped to 102,300 tons from 138,631. The unfilled orders for copper products were well under the lowest figures during the recession of 1953-'54. Somewhat more encouraging were Copper Institute producer statistics. Deliveries outside the U.S. were at a new high and in the U.S. they improved. Production was also very high; crude output was so high that some analysts questioned the announced output reductions.

Weakness of copper in Europe some regarded as curious. Several major producers indicated they were turning down requests for copper for delivery in the first half of 1958; this it was assumed should mean rising copper prices. But, 1) some producers had been turning down business offered at LME prices for several months, 2) some European fabricators may feel they have overbought on LME fixings and may have to postpone taking copper or return it or resell some of it, 3) producer stocks of 448,900 short tons means refined stocks are almost twice as high as "normal" and so copper must be available and 4) there is pessimism in Europe owing to the U.S. recession.

Lead sales in the U.S. in February were probably the lowest on record. Many observers believe shipments will be very low. In January, according to the American Bureau of Metal Statistics, shipments were 33,422 tons, far under "normal"; an additional 4,635 tons were shipped to others. Stocks rose 9,608 tons to 101,206. Output in the U.S. was 47,665 tons. GSA asked for tenders; it has been taking about 5,000 tpm. St. Joseph Lead Co. will close its S.E. Missouri mines for three weeks and reduce output of lead by 6,000 tons. The London lead price in January had been under parity with the U.S. even after the addition of ocean freight, the present duty and the expected increase of 1.49c in the duty. Most analysts believed this low price in London reflected the expectation that the U.S. price of 13c would be reduced. In February, London rose so that it was only about 0.3c under parity. Many believe that since the 13c has lasted this long it will not be dropped. U.S. producers have been able to sell little lead near the East Coast for months. Much lead from outside the U.S. is sold here with the option to the buyer of the *E&MJ* price or the LME plus the duty plus ocean freight. In some cases the freight charge is arbitrary and fixed at less than ½c. Some buyers have been getting lead delivered U.S. ports at about 10¾c.

Zinc sales in the U.S. by major sellers, their reports to *E&MJ* suggest, may have been lower in February than in any month for years. Matthiessen & Hegeler Zinc Co. is reducing output of slab zinc by 850 tpm at its West Virginia smelter. Eagle-Picher closed its Henryetta smelter Feb. 15. St. Joseph Lead Co. is cutting zinc concentrate output 2,000 tpm. Metal output is being cut in February and March. Heath Steele Mines in New Brunswick will maintain only a development and metallurgical staff. President Eisenhower strongly implied he still favors higher tariffs for zinc and lead. U.S. producer slab zinc stocks rose 14,000 tons in January; they are now at the highest level since August 1954.

Copper Production and Stocks



E&MJ U.S. price is the monthly weighted average for domestic copper, in cents per lb. Other data are from the Copper Institute and are in thousands of short tons. They include January 1958. The two series "X-U. S." are the world producer statistics less the U. S. No fabricator stocks are included.

Antimony metal prices were dropped 4c a lb by National Lead effective Feb. 14. Imported metal had been selling through most of 1957 about 8 or 9c lower per lb. Antimony ore prices have been low.

Commercial grade selenium was dropped to $7 per lb by Canadian Copper Refiners on Feb. 19; high purity was dropped to $9.50 U.S. sellers followed effective the same date. European prices were reduced earlier. Some observers say selenium use in steel and rubber has dropped. Few say rectifier use is down.

Copper Import Tax

AGREEMENTS between the U.S. and other countries in connection with the General Agreements on Tariffs and Trade provide that for three years beginning with 1956, U.S. import duties are reduced by 5% per year. Accordingly, it was thought the import tax if reimposed would be 1.8c rather than 2c. This is not the case, and the statements in the February issue of *E&MJ*, pp 42 and 115, on this subject are wrong. The agreement specifically refers to copper and provides that the concessions (5% each year) will not be effective when the delivered price in the U.S. is under 24c.

If the average delivered price drops to under 24c in the U.S. for a calendar month, the Tariff Commission must notify the President within 15 days and within an additional 20 days he must revoke the suspension of the copper import tax. Since the GATT arrangements do not apply to copper when it is under 24c, the 2c tax would come into effect. If Congress were to rescind the suspension and the price were, as now, 24c or above, the 1.8c tax would apply. Since the Congressional suspension of the duty automatically ends June 30, 1958, unless the Congress reimposes it, the duty will be 1.7c if the price is 24c or above. But if at that time the price is below 24c delivered as indicated by *E&MJ Metal and Mineral Markets*, the concessions under GATT do not apply (in the case of copper in ores or in any other articles) and the 2c tax comes into effect. Whichever of these taxes apply, it is in addition to the present import duties on many copper and brass articles.

Average Prices Feb. *(E&MJ Quotations)*

Copper:	
Electrolytic, domestic refinery	24.397
Electrolytic, export refinery	20.079
Lead:	
Common, New York	13.000
Common, St. Louis	12.800
Silver and sterling exchange:	
Silver, New York, per oz.	88.625
Silver, London, pence per oz.	76.375
Sterling Exchange	281.572
Zinc:	
Prime Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
Tin:	
New York Straits	93.710
Gold per oz. U. S. price	$35.000
Quicksilver, per flash	$221.864
Antimony, (EM&J) (d)	34.408
Antimony, bulk, Laredo	30.818
Antimony, in cases, Laredo	31.318
Platinum, refined, per oz.	$74.818
Cadmium (a)	155.000
Cadmium (b)	155.000
Cadmium (c)	155.000
Aluminum, 99% plus ingot	28.100
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Trading declined by 8% in February. No Soviet sales were announced. Private dealings showed Paris leading. Latin American markets were quiet. Near Eastern dealings rose as did trading in the Far East where coin prices soared in Indonesia. Pick's World Currency Report quotes on "free gold" per fine oz. as follows:

	COINS		BARS (12.5 kg)	
	Jan. 31	Feb. 28	Jan. 31	Feb. 28
NEW YORK, transit	.....	.....	$35.08⅛	$35.08⅛
MANILA	$43.25	$43.00	36.50	36.30
HONG KONG	47.00	47.50	38.50	38.75
BOMBAY	57.50	57.75	57.00	57.00
TANGIER	42.55	42.65	35.00	35.10
BEIRUT	41.50	41.50	35.12	35.21
PARIS	41.50	40.45	36.13	36.40
BUENOS AIRES	38.50	37.75	35.90	36.05

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S., for month of February reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling commission.

Delivered Consumers' plant. 23.250c lb
F.o.b. refinery ..... 22.850c lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Feb. 1958	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	St. Louis	Zinc (f) Delivered	East St. Louis	Aluminum 99%	Straits Tin New York
1	No Market	20.325	13.000	12.800	10.500	10.000	26.000	93.000
3	24.575	20.475	13.000	12.800	10.500	10.000	26.000	92.875
4	24.400	20.625	13.000	12.800	10.500	10.000	26.000	92.750
5	24.575	20.475	13.000	12.800	10.500	10.000	26.000	93.125
6	24.500	20.450	13.000	12.800	10.500	10.000	26.000	93.250
7	24.450	20.350	13.000	12.800	10.500	10.000	26.000	93.000
8	No Market	20.350	13.000	12.800	10.500	10.000	26.000	93.000
10	24.500	20.425	13.000	12.800	10.500	10.000	26.000	92.750
11	24.500	20.250	13.000	12.800	10.500	10.000	26.000	92.750
12	Holiday	19.575	Holiday					
13	24.550	20.050	13.000	12.800	10.500	10.000	26.000	93.250
14	24.500	20.375	13.000	12.800	10.500	10.000	26.000	93.375
15	No Market	20.375	13.000	12.800	10.500	10.000	26.000	93.375
17	24.500	19.925	13.000	12.800	10.500	10.000	26.000	93.250
18	24.450	20.050	13.000	12.800	10.500	10.000	26.000	94.000
19	24.450	19.825	13.000	12.800	10.500	10.000	26.000	94.375
20	24.125	19.825	13.000	12.800	10.500	10.000	26.000	94.625
21	24.300	19.925	13.000	12.800	10.500	10.000	26.000	94.875
22	No Market	19.925	Holiday					
24	24.175	20.050	13.000	12.800	10.500	10.000	26.000	95.375
25	24.100	19.800	13.000	12.800	10.500	10.000	26.000	95.000
26	24.375	19.725	13.000	12.800	10.500	10.000	26.000	94.500
27	24.300	19.375	13.000	12.800	10.500	10.000	26.000	94.625
28	24.225	19.375	13.000	12.800	10.500	10.000	26.000	94.500
	AVERAGES FOR MONTH							
Feb.	24.397	20.079	13.000	12.800	10.500	10.000	26.000	93.710
Feb.	**AVERAGES FOR WEEK**							
5	24.515	20.438	13.000	12.800	10.500	10.000	26.000	93.042
12	24.488	20.233	13.000	12.800	10.500	10.000	26.000	92.950
19	24.490	20.100	13.000	12.800	10.500	10.000	26.000	93.604
26	24.215	19.875	13.000	12.800	10.500	10.000	26.000	94.875
Feb.	**CALENDAR WEEK AVERAGES**							
1	24.475	20.204	13.000	12.800	10.500	10.000	26.000	93.354
8	24.500	20.454	13.000	12.800	10.500	10.000	26.000	93.000
15	24.513	20.175	13.000	12.800	10.500	10.000	26.000	93.100
22	24.365	19.913	13.000	12.800	10.500	10.000	26.000	94.225

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Feb. 1958	Silver (c) New York	London	Sterling Exchange	Gold London	(d) United States
1	(e)	(e)	(e)	(e)	$35.00
3	88.625	76.125d.	281.6625	249s. 1½d.	35.00
4	88.625	76.125d.	281.6875	249s. ¾d.	35.00
5	88.625	76.125d.	281.6562	249s. 1d.	35.00
6	88.625	76.250d.	281.6562	249s. 2½d.	35.00
7	88.625	76.250d.	281.6562	249s. 1½d.	35.00
8	(e)	(e)	(e)	(e)	35.00
10	88.625	76.250d.	281.7500	249s. ½d.	35.00
11	88.625	76.250d.	281.7812	248s. 10½d.	35.00
12	Holiday	76.375d.	Holiday	248s. 10d.	35.00
13	88.625	76.375d.	281.7187	248s. 10½d.	35.00
14	88.625	76.375d.	281.6875	249s. ½d.	35.00
15	(e)	(e)	(e)	(e)	35.00
17	88.625	76.375d.	281.7500	249s. ½d.	35.00
18	88.625	76.375d.	281.7812	249s. 0d.	35.00
19	88.625	76.375d.	281.6875	249s. ½d.	35.00
20	88.625	76.375d.	281.6875	249s. 2d.	35.00
21	88.625	76.375d.	281.5625	249s. 2d.	35.00
22	(e)	(e)	(e)	(e)	35.00
24	88.625	76.625d.	281.4687	249s. 3d.	35.00
25	88.625	76.625d.	281.2500	249s. 4½d.	35.00
26	88.625	76.625d.	280.9270	249s. 5¾d.	35.00
27	88.625	76.625d.	281.0625	249s. 9¾d.	35.00
28	88.625	76.625d.	281.4375	249s. 4¾d.	35.00
	AVERAGES FOR MONTH				
Feb.	88.625	76.375d.	281.572	—	35.00
Feb.	**AVERAGES FOR WEEK**				
5	88.625	—	281.626	—	35.00
12	88.625	—	281.711	—	35.00
19	88.625	—	281.725	—	35.00
26	88.625	—	281.379	—	35.00

Calendar Week Averages: New York Silver: Feb. 1st, 88.625; 8th, 88.625; 15th, 88.625; 22nd, 88.625.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

	COPPER				LEAD				ZINC				TIN			
	Cash		3 Mo.		Current Month		3 Mo.		Current Month		3 Mo.		Cash		3 Mo.	
Feb.	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked								
3	169¼	170	170½	171	73½	74	73¾	74	64½	64¾	64	64¼	730	730½	729½	730
4	164½	165	166	166¼	72¾	73¼	73	73½	63¾	64	63¼	63½	730	730½	728½	729
5	167¼	167½	168¼	168½	73½	73¾	73½	73¾	65	65½	64	64¼	730	730½	729	730
6	164¾	165	166	166¼	73¼	73½	73¾	73½	65	65¼	64	64¼	730	730½	731	731½
7	163¾	164	165¼	165½	73¼	73½	73½	73½	65¼	65½	64⅜	64½	730	730½	729	729½
10	162½	162¾	164	164¼	73½	73⅝	73⅝	73¾	65	65¼	64⅛	64⅛	730	730½	727	727½
11	160½	160¾	162	162¼	73½	73⅝	73½	73⅝	64	64¼	63½	63¾	730	731	726½	727
12	160½	160¾	161¾	162	73⅜	73¾	73¾	73½	64	64½	63½	63¾	730	730½	727	727½
13	160	160½	161½	161¾	73½	73¾	73½	73¾	63¾	64¼	63¼	63½	730	730½	729½	730
14	160¾	161	161¾	162	74	74½	73¾	74	63½	63¾	63½	63⅜	730	730½	730½	731½
17	162¾	163¼	163¾	164	74¼	74½	74	74¼	64	64¼	63¾	64	730	730½	731	731½
18	162½	162¾	163½	163¾	74½	75	74¼	74½	63¾	64	63¼	63¾	731½	732	732	733
19	163½	163¾	164¼	164½	76	76¼	75½	75¾	64½	64¾	63½	64	736	737	738	739
20	162¾	163	163¾	164	75¼	75½	74¾	75	64	64½	63¾	63⅞	733	734	735	736
21	163¾	164	165	165¼	75¾	76	75¼	75½	64	64½	63¾	63¾	735	736	737½	738
24	163	163¼	164½	164¾	75⅝	75¾	75⅛	75½	63½	63¾	63½	63⅜	737	738	739	740
25	161¼	161½	163	163¼	74¾	74⅞	74½	74¾	63	63¼	62¾	63	731	732	734	735
26	160½	160¾	161¾	162	74⅛	74¼	73½	73¾	61¾	62	62¼	62½	730	730½	732½	733
27	160½	160¾	161¾	162	73½	73¾	73¼	73½	61¼	61½	62	62¼	731	731½	735½	736
28	160¼	160½	162	162¼	73	73¼	73	73¼	61¼	61½	62¼	62½	730	730½	734	734½
Av'g'e.	£162.888		£164.144		£74.178		£74.025		£63.856		£63.547		£731.550		£732.138	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98¾ and tin min. 99.75%

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton.

MISCELLANEOUS METALS

February 28, 1958

Aluminum ingot, 99"plus"% lb.		28.1¢
Antimony, spot, lb. less than carload, in cases		32.59¢
In bulk, carload lots, f.o.b. Laredo		29.00¢
Bismuth, ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.55
Calcium lb. ton lots 98%, cast		$2.05
Chromium, 97% grade, lb. contract del.		$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957		$2.00
Germanium, per gram, 10,000 gram lots	(c)38¢ @	(d)45½¢
Indium, troy oz.		$2.25
Lithium, lb. 98%	$11.00 @	$14.00
Nickel, cathodes, lb (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.	70¢ @	75¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16		35¼¢
Palladium, troy oz.	$19.00 @	$21.00
Platinum (wholesale lots), troy oz.	$71 @	$75
Quicksilver, flask of 76 lb., 25 flasks or more	$228 @	$232
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		22¢
Semi-Conductor grade, lb.		$350
Tellurium, lb.		$1.65
Thallium, 100 lb. or more, lb.		$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb.		(b)$2.25

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective June 3, 1957.
(c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$34.00 @	$35.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$26 @	$26.50
48% Cr_2O_3 3 to 1 ratio	$47 @	$57
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi, non-bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$156.12
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.33 @ 1.36; both duties excluded, $1.195 @ $1.225. Long-term contract nominal.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18 @	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.15 @	$1.20
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$10 @	$12.50
U. S. scheelite, f.o.b. mill	$19.50 @	$20
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton		$56

(a) Nominal.
(e) Eff. 1957 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb eff. Jan. 13, '58		$10.70
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.38 @	$1.41
Imported, incl. 37¢ duty	$1.75 @	$2.05

ALLOYS

Ferrochrom"65 to"70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo. lb. of Mo contained	$1.68 @	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)		14.20
Ferrotungsten, 72 to 82%, lb. of W contained		$2.15
Ferrovandium, per lb. of V delivered	$3.20 @	$3.40
Silicomanganese, max. 1½% carbon, lb., contracts		12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,470 @	$1,810
Crude No. 2	$788 @	$1,155
Spinning fibers	$353 @	$593
Shingle fibers	$190 @	$220
Paper stock	$120 @	$142
Waste	$82 @	$86
Shorts	$27 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$494 @	$787
Shingle fibers	$142 @	$325
Asbestos, Vermont, f.o.b. Hyde Park:		
Spinning fibers	$353 @	$383
Shingle stock	$172 @	$190
Paper stock	$114 @	$145
Waste, stucco or plaster		$82
Refuse or Shorts	$39 @	$72
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)		$18
Imported, c.i.f. Gulf Ports, st.	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00 @	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Some sellers quote		$55
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $32.50 @ $70.00 per ton. Scrap, $25 and up.		
Ocher, Georgia, ton, in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports		Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright		$23.50
dark	$22.50 @	$23
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$31.60
For export f.o.b. vessel, lt, dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$77.50
Structural shapes, Pa., Ala., etc, 100 lb.	$5.10 @	$5.275

WATCH THESE TRENDS

ALUMINUM

Rolls wrapped in transparent materials and exposed to bright lights of supermarkets lose vitamin B_2, riboflavin. Recent tests showed that after seven day's exposure to such light, rolls wrapped in transparent film lost 60% of the vitamin B_2 content; those wrapped in waxed paper lost 40% while those wrapped in aluminum foil lost only 5%.

General Electric Co. is developing a dry-type transformer from 300 to 2,000 kva containing aluminum conductors and bus work throughout. It is insulated with a unique inorganic called alpholite. The new line of transformers, inherently fire-and-explosion resistant, will handle long and extreme overloads with essentially no loss of insulation life.

BORON

High-energy fuel production in 1959 will require about 1.5% of the current U.S. borate production, according to estimates of D. R. Gibbons of Arthur D. Little, Inc.

COBALT

A new cobalt alloy, J-1570, has been developed by General Electric Co. which enables gas-turbines to withstand high stresses at high temperatures. Composition is 41.8% Co, 0.2% Cr, 28.0% Ni, 6.0% W, and 4.0% Ti.

DIAMONDS

Hopes persist that U.S. will gain complete independence in industrial diamonds through manufacture by high-temperature, high-pressure processes, reports General Electric Co. in a recent review of its research programs.

GALLIUM

Dow Chemical Co. has developed a new process to recover gallium from ores. Crushed material containing the element is treated with hydrogen chloride at temperatures of 700 to 950 deg C. The metal volatilizes as a chloride and is produced in pure form by condensation.

LEAD

Ethyl Corp.'s new additive, an organo-manganese compound, will be used first in aviation gasoline. It will add 20% to the cruise power of the plane, and about 7% to the cruise speed. The new additive is a supplement to tetraethyl lead and not a substitute.

LIGHT METALS

Organo-compounds of aluminum, magnesium, lithium and beryllium may find military applications as fuels. When the compound triethylaluminum constitutes 15 to 20% of jet fuels, it prevents flame-outs, and hence loss of power at high altitudes.

SILICON

Silicon performs more favorably than germanium in large semi-conductor power rectifiers, according to a GE report. New silicon rectifiers have been operated at 140 to 350 amp, whereas the maximum for germanium types has been 100 amp. Maximum voltage for the silicon cell was 400 v, as compared with 200 v for the germanium unit.

GENERAL

The following compounds have the highest melting points of any known material which might be suitable for use in reactors: columbium carbide, 6,800 deg F; graphite, 6,700 deg F; zirconium carbide, 6,400 deg F; titanium nitride, 5,800 deg F; barium phosphide, 5,790 deg F; titanium carbide, 5,700 deg F; zirconium nitride, 5,400 deg F; vanadium carbide, 5,090 deg F; strontium zirconate, 5,070 deg F; magnesium oxide, 5,070 deg F; zirconium oxide, 4,900 deg F; and molybdenum, 4,760 deg F.

THIS MONTH IN MINING

Kennecott Takes Possession of Coppermines Pits

KENNECOTT COPPER CORP. has purchased the White Pine, Nev. properties of Consolidated Coppermines Corp. in an $8.4-million cash deal.

The transaction was completed in New York City between Charles R. Cox, KCC president, and Chester D. Tripp, a resident of Chicago, Ill., who heads Coppermines.

It concludes off-again-on-again discussions over the last 25 years which were revived under the stress of current low prices a number of weeks ago.

Crux of the problem was that neither Nevada Mines Division nor Consol Copper could operate without each other. If Consol Copper had closed under the 25c a lb price of Cu, then it is probable that Nevada Mines Div. would have had to close operations at McGill, Nev. reduction center (concentrating and smelting).

Coppermines' subsidiaries Titan Metals Mfg. Co. and Rockbestos Products Corp. were not involved in the deal. Consol Copper, while producing copper-brass products through its Titan operation, is not an integrated copper firm.

American Metals Co. Ltd. processed Consolidated Coppermines blister from McGill smelter and is 10% owner of the firm.

Solution of blister copper supply (from this source) for American Metal was a factor in completion of the deal, as American Metal had a contract with Coppermines.

Kennecott took physical possession of the Coppermines properties at Kimberly, Feb. 1. A. J. O'Connor, vice president and general manager of Coppermines at Kimberly, will continue active in exploration for minerals for Coppermines.

O'Connor announced on Jan. 31 that 200 employees of the firm were being laid off immediately as a result of the sale of the company's Nevada property to Kennecott. Only 15 employees of Consolidated in Nevada will be kept on the payroll and will be transferred to other areas for exploration activities in the western states.

The big Tripp pit, a principal holding of Coppermines in White Pine County, will be closed down under an "assimilation of newly acquired properties" requiring a "revision of mining procedures," announced J. C. Kinnear Jr., Nevada Mines Div. general manager.

In addition to the Tripp pit, the sale included contiguous Coppermines holdings in Kennecott's adjacent Liberty and Veteran pits along with numerous mining claims, water rights, surface buildings, equipment and the company-owned community of Kimberly and other real estate.

As Kennecott has followed a program of getting out of company housing at all western copper properties in recent years, it appears Kimberly will not be retained as a company-run program.

The two companies and their predecessors have operated side by side at Ruth and Kimberly for more than 50 years. The relationship has not always been an easy one—particularly with the overlapping claims in two major pits.

Completion of this deal marks one of the largest mine transactions in recent years in Nevada.

Mr. Kinnear said that in recent years necessary mining procedures have overlapped perimeters of the Tripp and Veteran pits, creating conflicts in interests and preventing badly needed economies necessary for competition in the world copper market.

"It has been apparent for some time that one ownership with its resulting economies would be mandatory if the properties were to continue operations and have a future security," he said.

He said the orderly "development of the pits would lengthen the life of operations in the district and improve the stability of the mining industry, both in White Pine County and in Nevada."

He said for the nonce, plans were under way to intensify operations in the Liberty and Veteran pits to make up for ore previously supplied by Coppermines from the Tripp pit.

Coppermines production has been averaging 9,000 tpd ore with 7,000 tons coming from the Tripp pit and 2,000 tons mined by Kennecott for Coppermines' account in adjoining claims in the Liberty and Veteran pits. Output from Kennecott properties has been at the rate of about 12,000 tpd.

Kinnear said Nevada Mines Division would continue to run 21,000 tpd ore through its concentrator.

The plant has been on a six-day work week, representing a cutback from seven days in 1957.

Records of Consolidated Coppermines show that that firm and its predecessor companies have been active in copper mining the last 50 years in White Pine County. Underground developments covered the Richards, Alpha, Emma and Morris ore zones.

Underground mining was shut down

RR LOADING BINS (left) receive ore from the primary and secondary crushers at the Iron Baron mine, South Australia, where Broken Hill plans 1-million ton output.

Broken Hill Reopens Pit at Iron Baron

A NEW OPEN-CUT iron ore project went into action in Australia when an expenditure of $3-million resulted in the resumption of work at Iron Baron, South Australia. Project was undertaken by Broken Hill Pty. Ltd.

Production is expected to build up steadily to a rate of just over 1-million tons a year. The quarry is only 20 miles to the south of the world-famous Iron Monarch deposit.

Orebody is being developed in a series of 50 ft benches. Drilling is by Bucyrus-Erie blast holers with 9-in bits to the full depth of the face. Holes are loaded rapidly and 10 to 20,000 tons of ore broken in a single blast.

Marion shovels (6 cubic yd) load into 30-ton Mack trucks for the trip to the primary crusher. Truck bodies and hydraulic hoists were manufactured in Australia.

At the primary crushing plant, the ore is dumped onto a large pan feeder feeding at a controlled rate to an 84x60-in. jaw crusher. This is a Swedish machine with roller bearings and v-belt drive from a 250 hp electric motor.

From here the ore passes by belt conveyor to twin 5 ft 6 in. locally-manufactured gyratory crushers reducing it to maximum 2½ in. dia. Finally, it is elevated by further conveyor belts to train loading bins with a live storage capacity of 2,000 tons each and is carried by rail to the port of Whyalla.

in 1949 with conversion to open cut work. Coppermines' underground prominence occurred during three periods—World War I, the 1920's boom and during World War II.

During World War I, there were 1,200 men employed and about the same number worked in the mines during the 1929, pre-depression days.

Just before the start of World War II, there were some 1,000 men employed at Coppermines. Providing impetus for the 1929 boom was the Emma Nevada property—which took three years to get into operation.

The Emma later became the top producer at Kimberly with a huge skip surfacing 9,000 tons of ore per day in 1941.

By 1913, six companies, the Giroux, Ely Mines, Chainman, Ely Central, Butte and Ely Mining Co., were operating in the area.

They merged that year to form Consolidated Coppermines Co. In 1922, the present Consolidated Coppermines Corp. was put together.

In 1932, when price of copper dropped to 5c a lb, Kimberly was forced to close.

Mining Calendar

18th Annual Meeting, American Congress on Surveying & Mapping. Shoreham Hotel, Washington D.C. March 23-26

24th Annual Meeting, American Society of Photogrammetry. Shoreham Hotel, Washington D.C. March 26-29

Pacific Southwest Conference, AIME. St. Francis Hotel, San Francisco, March 27-29

American Chemical Society, 133rd National Meeting. San Francisco, April

Pacific Northwest Regional Conference, AIME, Spokane, Wash. April 17-19

3rd Annual Mining, Mineral, and Petroleum Conference of Alaska Section. U. of Alaska, April 18-20

Canada-United States Conference On Chemical Engineering. Montreal, April 20-23

North Texas Section, AIME, 3rd Bienniel Secondary Recovery Symposium. Wichita Falls, Kan., May 5-6

Symposium on the Problems of Design and Emplacement of Mine Stope Fill. Montana School of Mines, Butte. May 9 and 10

3rd Annual Uranium Symposium, Uranium Section, AIME, Moab, Utah, May 9-11

34th Annual conference, Lake Superior Mines Safety Council, Allen D. Look, 329 Federal Bldg., Duluth, Minn. May 22 and 23

3rd Reactive Metals Conference, Niagara Frontier Section, AIME, Statler Hotel, Buffalo, N.Y., May 27-29

Rocky Mountain Minerals Conference, AIME, Salt Lake City, Sept. 10-12

13th Purdue Industrial Waste Conference & Exhibit. Convention Hall, Philadelphia, Pa., Sept. 15-19

(*Continued on page 148*)

As We Went to Press . . .

Jones & Laughin Steel Corp., in partnership with Cleveland-Cliffs Iron Co., has exercised its option to obtain a 99-year lease on the Mt. Wright iron property of Quebec Cobalt & Exploration Ltd.

Approximately 1-billion tons of crude ore, containing 335-million tons of iron concentrates have been proven by drilling and indicated by mapping, J&L said. Both gravity and electrostatic separation methods have been tested to extract the specularite and hematite ores. "Tests to date," J&L says, "have yielded . . . grade of iron concentrate up to 70%, with recoveries as high as 97.5% The process employs a dry feed."

Property is located about 180 miles north of Seven Islands and five miles north of Cartier Mining's Mt. Wright deposits.

Merger of Lindsay Chemical Co. into American Potash & Chemical Corp. has been agreed to by the boards of the two firms, subject to approval of the stockholders. If the merger is consummated, Lindsay would become a division of American Potash. Charles R. Lindsay III, president of the Chicago firm, would become a director and vp of Potash and continue as president of the division.

Electrolytic copper capacity of Kennecott's new refinery at Baltimore, Md., will be increased to 16,500 from the initial 7,000 tpm planned output, according to Frank R. Milliken, vice president of Kennecott.

Enlarged plant will cost approximately $30-million, and will handle ores from KCC's domestic mines and Braden in Chile.

Johns-Manville has announced a new insulating material for rockets and missiles which the large asbestos firm contends is twice as efficient as any other known type.

"For the first time," a company official said, "an insulating material has been produced that has a lower conductivity than still air." He also noted that thermal conductivity decreases as altitude increases."

First quarter auto assembly schedules are being steadily cut back to "balance output to inventory," Detroit's favorite way of saying that cars aren't selling too well. Current forecasts call for about 1.4-million units, 300,000 under initial goals.

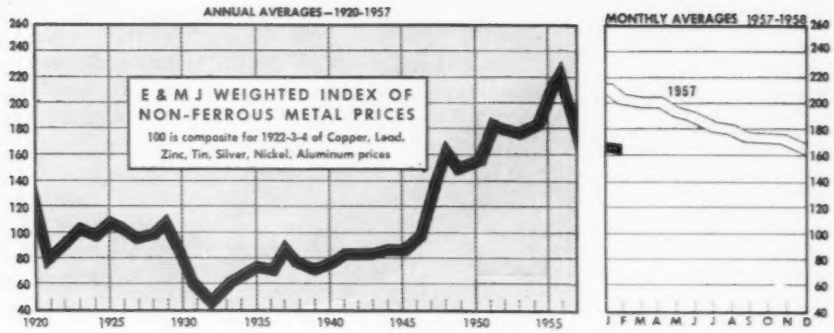
"Immediate" dispatch of drilling and prospecting crews is planned by M. A. Hanna Co. to the property of St. John d'el Rey, in Minas Gerais, Brazil.

The Cleveland iron ore and coal comany has taken over controlling interest in the mineral-rich area with a New York financial organization. Hanna investigators will also look into transportation and dock facilities. Property could be brought in within three years, Hanna said, if conditions warrant.

American Zinc Institute will hold its 40th annual meeting at the Chase-Park Plaza Hotels in St. Louis, Mo., April 14 and 15. Lead Industries Association will meet in joint session with AZI and continue its sessions through April 16.

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's metal price index dropped from 170.684 in January, to 168.376 for February. Copper's continued decrease and a drop of .8c in silver were not offset by a lc increase in the tin price.

•

AT HOME

Political pressure is building up behind the uranium producers' drive for Government help. Gordon A. Weller, Uranium Institute of America, told the Joint Congressional Atomic Energy Committee that AEC's cutbacks have hurt domestic producers seriously. A Government market guarantee or limited stockpiling may be in the offing. Stockpile proposals have already been endorsed by Congressmen.

Reserve Mining Co. will reduce production of taconite concentrates by 20% until demand for steel and steel products picks up.

A new process to recover high-grade alumina from low-grade ores and coal mines wastes is being developed by North American Coal and Strategic Materials.

What promises to be a long and drawn out Senate investigation of the state of the U.S. mining industry will get under way March 24 under Sen. James Murray (D-Mont.). Prompted by Interior Department delay in producing a long-range program, the committee will hear Interior Secretary Fred Seaton and Commerce's Sinclair Weeks, followed by industry representatives.

•

LABOR

Collective bargaining in 1958 will mean management will have to pay higher wages despite the recession. But labor, too, will have to cut its demands. Neither side will walk away happy, because conflicting demands will buck each other harder than in 1957, when strikes and disputes hit a post-war low.

•

ABROAD

Invitations will be sent out shortly by U.S. State Department to U.S. mining companies to participate in the new Cultural and Scientific Information Exchange program recently set up with the USSR.

"Deferment of plans" to bring Heath Steele lead-zinc-copper mine into full production have been announced by American Metal Climax. Rated 45,000 tpm, facility will "continue breaking-in at less than one-third of capacity."

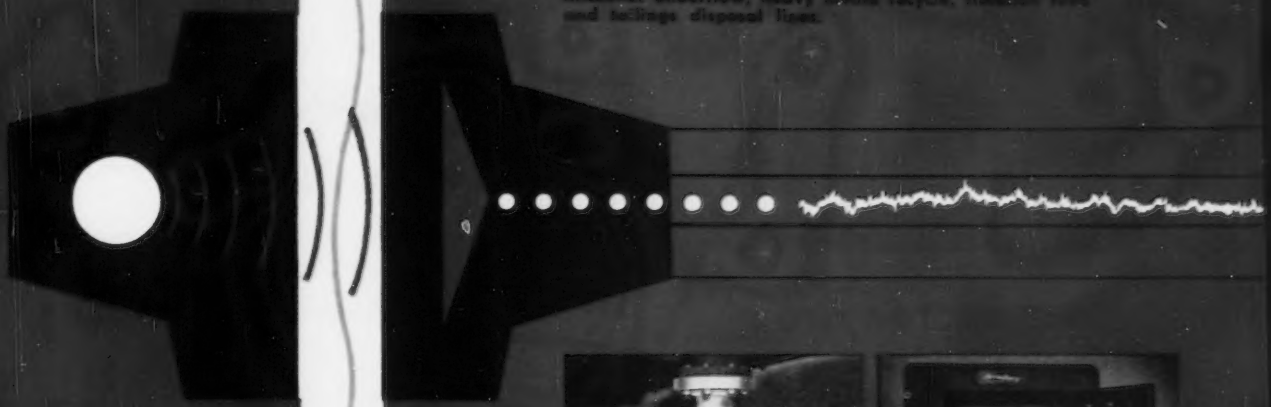
Leo Timmins, president of Compagnie Miniere de L'Ungava, says his company will continue work in the Wakeham Bay-Cape Smith District. Asarco dropped exploration plans on its nickel property in the area several weeks ago.

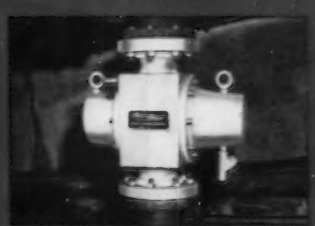
Increased gold interest in the U.S. and abroad is gaining strength in announcements from Quebec's eastern townships, where placers are being examined by M. J. Boylen interests and independent operators.

AccuRay® offers continuous flow density systems

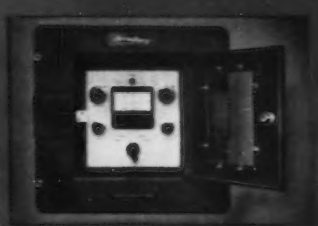
Accurately measuring liquid density, specific gravity, percent solids or related quantity, the AccuRay Density System applies nuclear radiation measurement to process control. Without contacting the process material, measurement is made continuously, independent of flow rate, pressure or viscosity. The AccuRay System is stable and rugged—designed to withstand shock and vibration under the most adverse industrial conditions.

Measurement of slurry density in the mining and ore dressing industries is easily accomplished. No plates, taps, purges or floats are used in the integral pipe section. Fouling cannot occur, and pipe erosion will not affect accuracy or safety of operation. To maximize throughput yield and profit, the system will continuously measure solids content in filter feed, jig circuits, cyclone output, thickener underflow, heavy media recycle, flotation feed and tailings disposal lines.





Assembly Measuring Head in Basic Industrial 4" Pipe System—Flange Connections.



The Amplifier Density Instrument also offers indicator and recorder. Field density values can be checked remotely from analog head.

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357

The World's Largest Manufacturer of Nucleonic Industrial Process Control Systems

58 NORDBERG GRINDING MILLS in Ore Concentration Plant

. . . largest iron ore mill installation under one roof in the world

Here, stretching about a quarter of a mile, are 27 Nordberg Rod Mills and 27 Nordberg Ball Mills in a concentrator building up in the Lake Superior Iron Range of Minnesota. The 54—10 foot diameter Nordberg mills reduce hard, abrasive Taconite Iron Ore to the fineness of flour. Four additional Nordberg mills serve as reserve replacement units.

This is but one example of the way in which Nordberg Grinding Mills, in sizes from 6 to 13 feet in diameter and up to 50 feet in length, are successfully serving the ore, mineral, cement and chemical processing industries of the world.

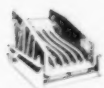
Years of specialized experience in the design, manufacture and installation of process machinery assure you that you can count on Nordberg, its machinery and "know how" to add efficiency and economy to *your* processing operations. For complete details, write for the Nordberg Grinding Mill Bulletin 232.

NORDBERG MFG. CO., Milwaukee 1, Wis.

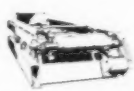
SYMONS PRIMARY GYRATORY CRUSHERS

SYMONS CONE CRUSHERS

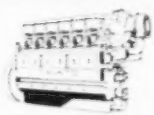
NORDBERG MINE HOISTS



SYMONS GRIZZLIES and SCREENS



SYMONS VIBRATING SCREENS



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GM158

Made its Reputation in the **SCHOOL OF HARD KNOCKS!**

Roebling SH-D Portable Power Cable

From its rugged, abrasion and weather-resistant Roeprene® Sheath, right to the heart of its extra-flexible conductors, Roebling SH-D Portable Power Cable was designed to give full-power performance. The extra quality features show you why Roebling SH-D is better in terms of superior service, ease of installation and maintenance. For more facts, write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Extra—Special semi-conducting tape around each super-flexible, stranded conductor to prevent ionization.

Extra—Butyl conductor insulation for outstanding electrical properties, plus heat, moisture and ozone resistance.

Extra—Free-riding, all-rubber fillers for moisture resistance, splicing and terminating ease, unusual flexibility.

Extra—A combination of properties which permits operation with copper temperatures up to 90° C.

WHEN MINING OR QUARRYING CALL FOR FAST, CLOSE-QUARTER LOADING—

Operators such as Floyd Davis like the Cat No. 955 Traxcavator with Side Dump Bucket because they can see where they are casting, and operator movements are kept to a minimum.

perfect answer is a CAT-built Traxcavator with Side Dump Bucket

This No. 955 Traxcavator with the new Side Dump Bucket Attachment is loading limestone for the Southwest Lime Co. near Neosho, Mo. Because of its in-line loading capabilities—just power it forward and reverse, no turning—it is easily able to do the work of *two* other machines (HT4s). Working underground in quarry rooms where turn space is at a premium, this speedy Caterpillar unit dumps both forward and to the left.

The new Side Dump Bucket is available for the Cat No. 977, No. 955 and No. 933 Traxcavators, with bucket capacities of 2¼ cu. yd., 1⅝ cu. yd. and 1⅛ cu. yd. respectively. Where you need elbow room, particularly in underground work, these durable units can't be matched for low cost-per-cu.-yd. material handling. And the Side Dump Bucket is interchangeable with the standard bucket—same pins, bolts and nuts used for mounting both.

In the limestone mining job shown here, the faster cycle time of the Side Dump Bucket unit is important because trucks haul the stone 300 yd. to the crusher. A slow loading operation could slack off the whole job. In other operations, too, these agile units keep production high . . . backfilling trenches, loading asphalt or concrete, removing snow and ice, excavating loose material.

This quarry site of the Southwest Lime Co. is producing about 700 tons of limestone per day for shipment to Kansas City for steel production. The Cedarapids crusher breaks the rock down to 7-in. lumps or smaller, before it is burned and shipped.

Side Dump Bucket Gives You—

1. Less maneuvering. Just a simple forward-reverse movement
2. Good view of loading field so operator can cast accurately
3. No turning to load
4. Reduction of loading area
5. Option to dump left or forward
6. Ability to load small trucks with minimum spillage
7. Minimum operator movement and cycle time

Phone your nearby Caterpillar Dealer today for a Side Dump Bucket demonstration. It has created a new dimension in earthmoving and materials handling, and will cut costs on *your* job.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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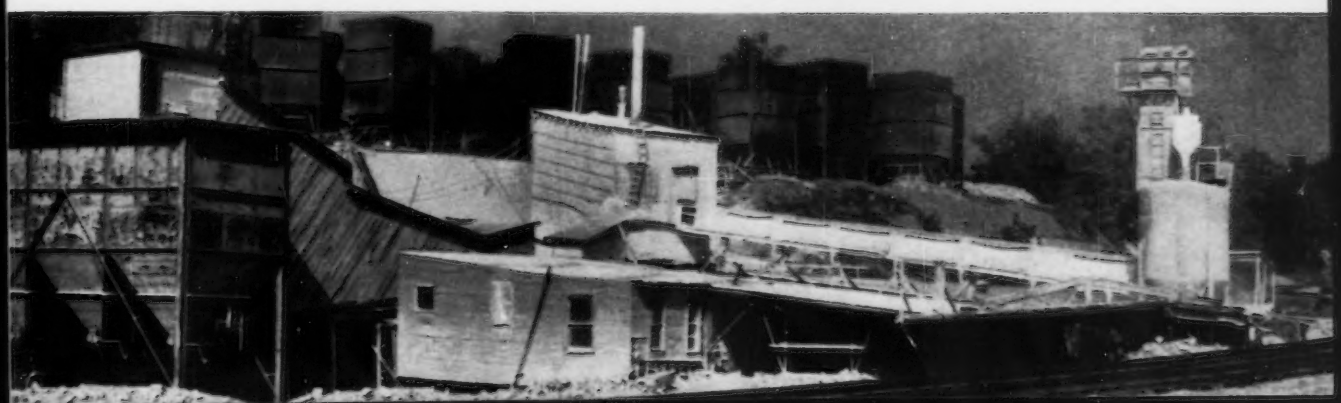
INCREASE JOB PROFITS WITH CAT-BUILT MACHINES



Are you sure you're blasting on the most profitable

KNOW YOUR

FREE,

basis ?

BLASTING COSTS!

simplified computing method — developed by Atlas — quickly gives you true, complete cost picture

Explosives costs alone don't always determine the value of blasting. The explosives you use have a direct effect on cost of drilling, digging, hauling and crushing. When you have all the cost figures at hand, you can eliminate guesswork—plug profit leaks wherever they occur, and wind up money ahead!

Atlas can show you how, with this new Blasting Cost Chart. It's simple to use—involves no extra bookkeeping. But what a difference it makes in knowing your true profits and how to protect or improve them!

The Atlas Blasting Cost Chart is yours without cost. Ask the Atlas representative nearest you for full details now!

EXPLOSIVES DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
offices in principal cities

New Dam on the Skagit

In Mount Baker National Forest, in Washington, wagon drills and jackhammers have been boring into hard granite along the Skagit River. Equipped in most cases with Bethlehem Hollow Drill Steel, these drills are putting down blast holes so that about 400,000 cu yd of rock can be moved to make way for the high Gorge Dam, a project of Seattle City Light.

The new dam, of concrete construction, is scheduled for completion in 1960. It will be about 670 feet long and 285 feet high, and will replace the existing Gorge Division Dam. By providing an 88-ft higher head of water, the capacity of the Gorge Powerhouse will be increased from 108,000 kw to 165,000 kw.

Whatever the type of rock removal, you're sure to get dependable drilling, and minimum breakage, with Bethlehem Hollow. This is because it is rolled from a special fatigue-resistant steel, and has a uniformly round hole which is centrally located in the bar. Bethlehem Hollow has a wide quenching range. It can be heat-treated easily for the proper balance of toughness and wear-resistance, resulting in durable threads and shanks.

Bethlehem Hollow, in Carbon and Ultra-Alloy grades, comes in rounds, hexagons, and quarter-octagons in lengths from 18 to 27 ft. Longer lengths can also be furnished to meet special requirements.

You'll like Bethlehem Hollow.

Using 1-in. hexagon Bethlehem Hollow for 12-ft blast holes at site of high Gorge Dam, on Skagit River, in Washington. Contractors: Merritt-Chapman & Scott Corporation.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL

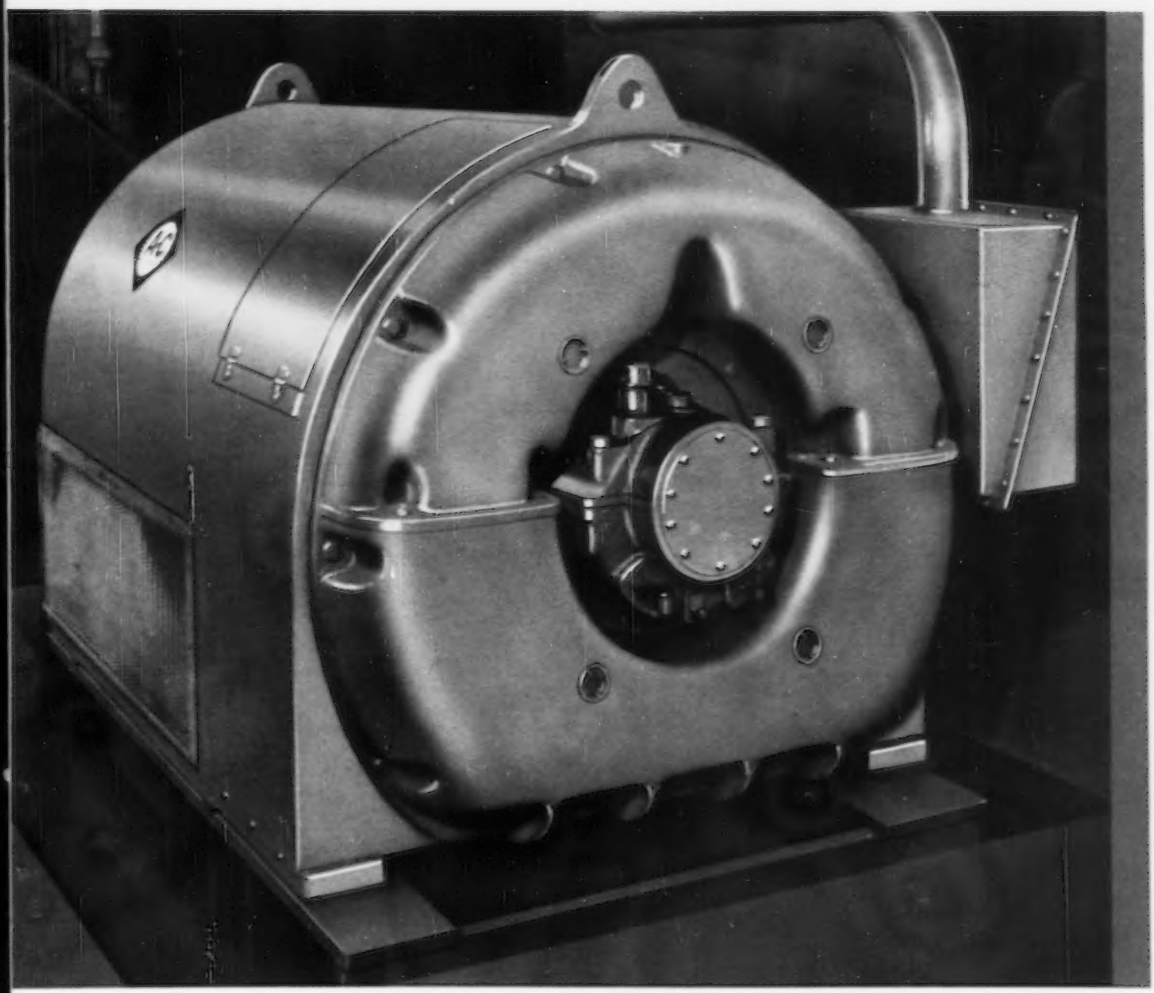
CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

Revolutionary Advance in Motor Protection

made possible by SILCO-FLEX insulation

plus 10 integrated mechanical features

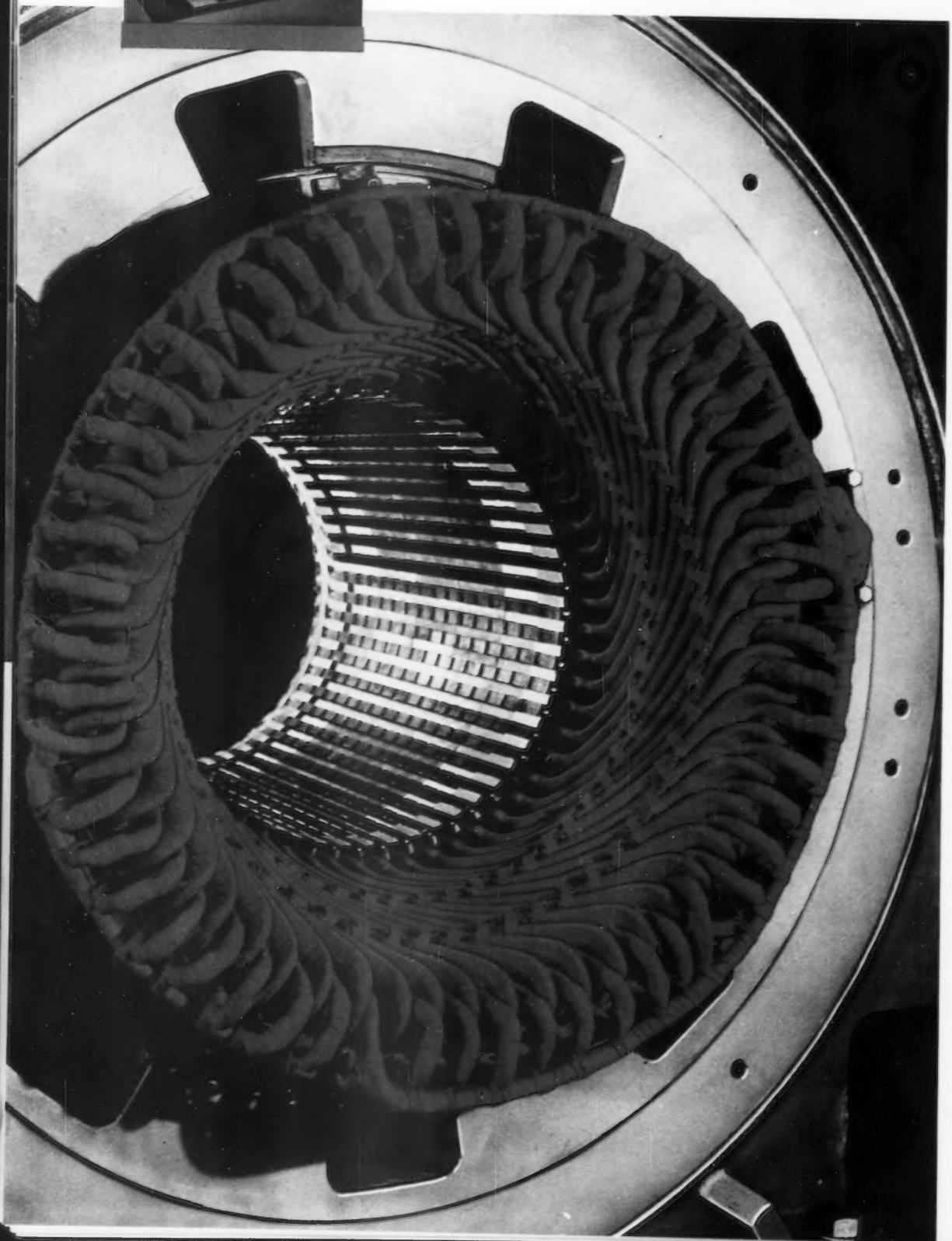


Designed to meet needs of chemical, paper, petroleum, metals, power and rock products industries where moisture, dirt, abrasive dusts or corrosive atmospheres are a problem.

ALLIS-CHALMERS

A-5636

New Motor is



super-sealed

It's drip-proof — yet withstands moisture • abrasive dust • chemicals • high humidity • heat

The *Silco-Flex* system of insulation is used on all stators. Field coils of synchronous motors are bonded in heat-stabilized resins, enclosed in a resin-impregnated sheath of oriented glass fibers and bond-locked on the pole structure.

The superior electrical protection of Super-Sealed motors results from the insulating *system* used... not just the insulating material. The same material, conventionally applied, would retain certain weaknesses of conventional insulation.

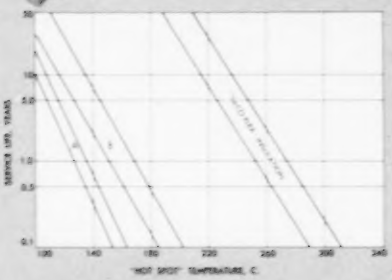
Applied the A-C way, it has these qualities that add reliability and service life:

Dimensionally stable — withstands heating, thermal shock, vibration and fatigue at elevated temperatures.

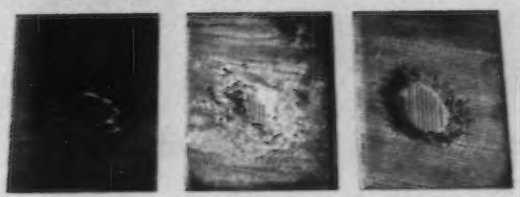
Sealed throughout — resistant to most chemicals, water, high humidity, weather, aging, corona and lubricants.

Homogeneous — provides a void-free dielectric barrier, homogeneous under extremes of differential expansion and contraction due to thermal cycling.

All Super-Sealed motors have revolutionary Silco-Flex insulation

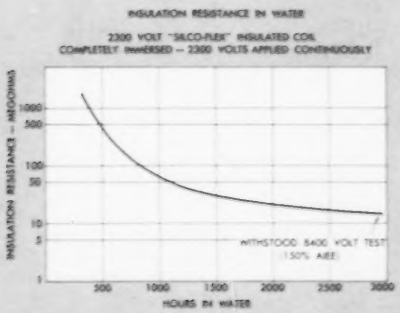


Heat resistant — *Silco-Flex* insulation gives much longer service life under higher temperatures than conventional materials.

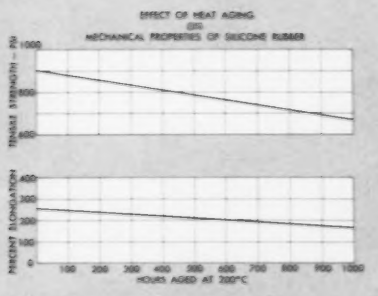


Silco-Flex Insulation | *Polyester Mica Tape* | *Asphaltum Mica Tape*

Abrasion resistant — Samples of insulation show effect after sandblasting for one minute with 90-grit aluminum oxide and 100-psi air. Nozzle to sample distance was six inches, thickness equivalent to 2300-volt insulation. Note difference in abrasion.


INSULATION RESISTANCE IN WATER
2300 VOLT "SILCO-FLEX" INSULATED COIL
COMPLETELY IMMERSED — 2300 VOLTS APPLIED CONTINUOUSLY
INSULATION RESISTANCE — MEGOHMS
WITHSTOOD 8400 VOLT TEST
(150% ABE)
HOURS IN WATER

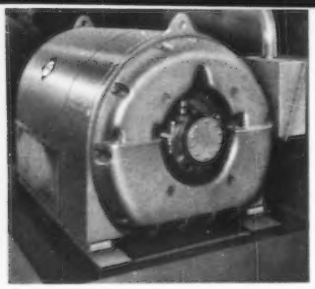
Moisture resistant — Test curve shows that *Silco-Flex* insulation, after 3000 hours of total immersion with 2300 volts impressed on coil, withstood high potential test of 8400 volts without injury.



Flexible, resilient — Rubbery *Silco-Flex* insulation remains flexible and resistant indefinitely. It is especially resistant to mechanical abuse and to stresses of overloading, rapid starting and stopping.

Silco-Flex is an Allis-Chalmers trademark.

ALLIS-CHALMERS



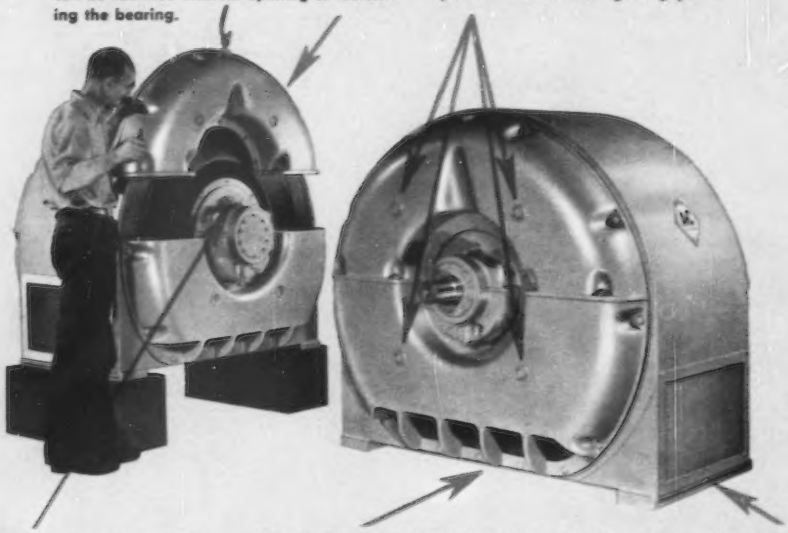
New Super-Sealed motors

10 mechanical features

Super-Sealed motors combine the perfect insulation with features that assure the mechanical as well as the electrical reliability of these motors.

Accessibility — Split-type end shields can be removed without opening or disturbing the bearing.

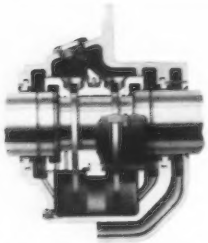
Ease of Inspection — Four points are provided for measuring air gap.



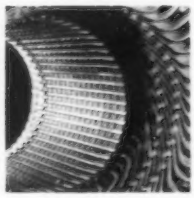
Clean Check — Glass inspection bulls-eye permits checking operation of oil rings without dirt falling inside bearing.

Full Circle of Protection — Steel plate across bottom of motor protects it from dirt and rodents.

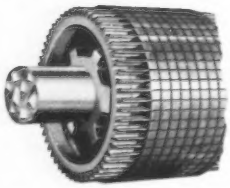
Clean Appearance — Foundation bolts are hidden, machine is clean-looking.



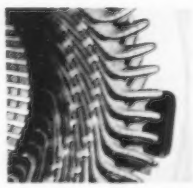
Self-Aligning Capsule-Type Bearings are center seated with single seat. Breather relieves pressure of oil in bearings that could cause leakage.



Precision Construction— Slot sticks are non-hygroscopic-trapezoidal, fabric base phenolic. End turns, spaced with polyester glass mat spacer pieces, are laced and tied with flat lubricated glass tubing for long trouble-free life.



Solid Construction—Silver-brazing rotor rods to end ring assures a good joint.

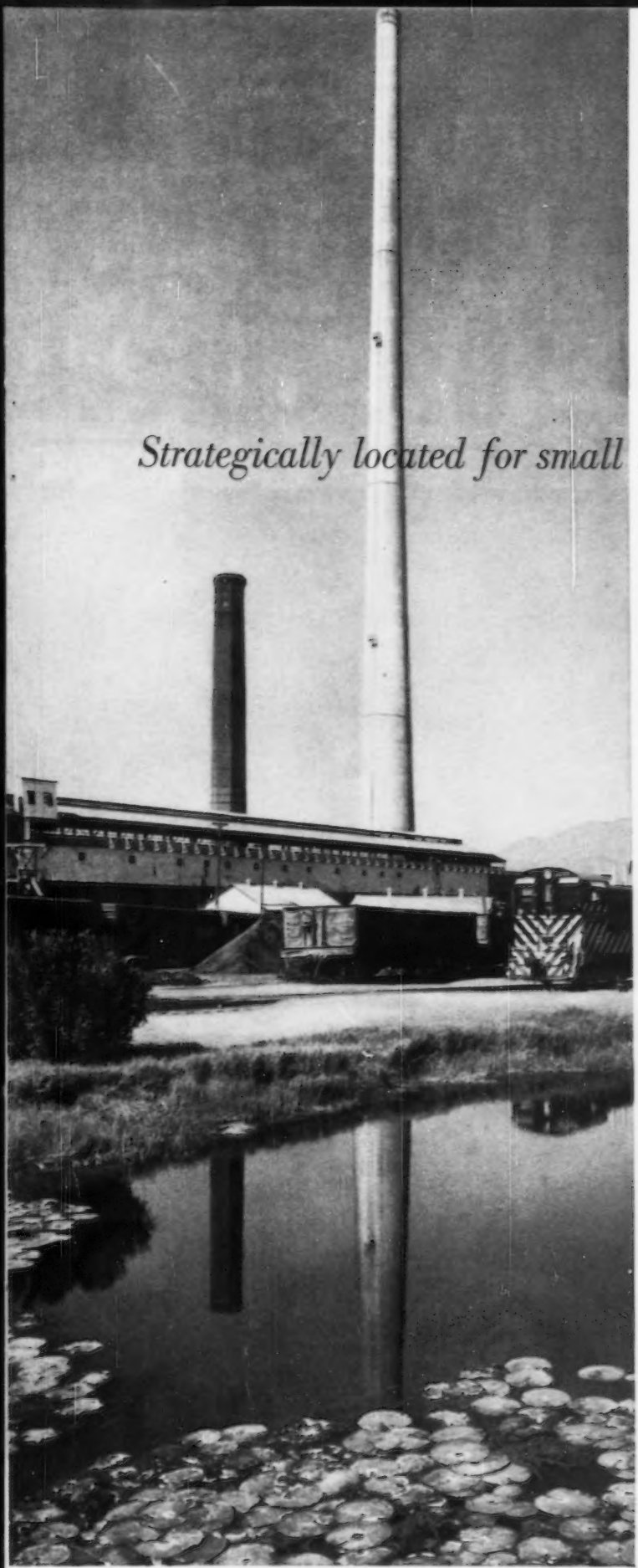


Rigid — End turns of higher speed motors are supported by insulated coil support rings to prevent injurious distortion due to high starting torque and frequent starting.

Timesavers—Separate plates provided to show direction of rotation and magnetic center. Terminal box is amply sized and diagonally split. Leads are brought out through grommet.

For the complete story, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS



See ASARCO first
buying, smelting, and
refining all types of ores:
GOLD, SILVER, LEAD,
COPPER AND ZINC ores
and concentrates, blister
copper, mattes and residues
22 Smelters and Refineries

Strategically located for small lots or carload quantities...

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Leadville, Colorado
Alton, Illinois
East Helena, Montana
El Paso, Texas
Chihuahua, Chih., Mexico
San Luis Potosi, S.L.P., Mexico

ZINC SMELTERS
Amarillo, Texas
Corpus Christi, Texas
Rosita, Coah., Mexico

COPPER SMELTERS
Hayden, Arizona
El Paso, Texas
Garfield, Utah
Tacoma, Washington
San Luis Potosi, S.L.P., Mexico

LEAD REFINERIES
Selby, California
Omaha, Nebraska
Perth Amboy, New Jersey
Monterey, N.L., Mexico

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Tacoma, Washington

See management
at above locations
or write to main office.
American Smelting and
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Ore Purchasing Department,
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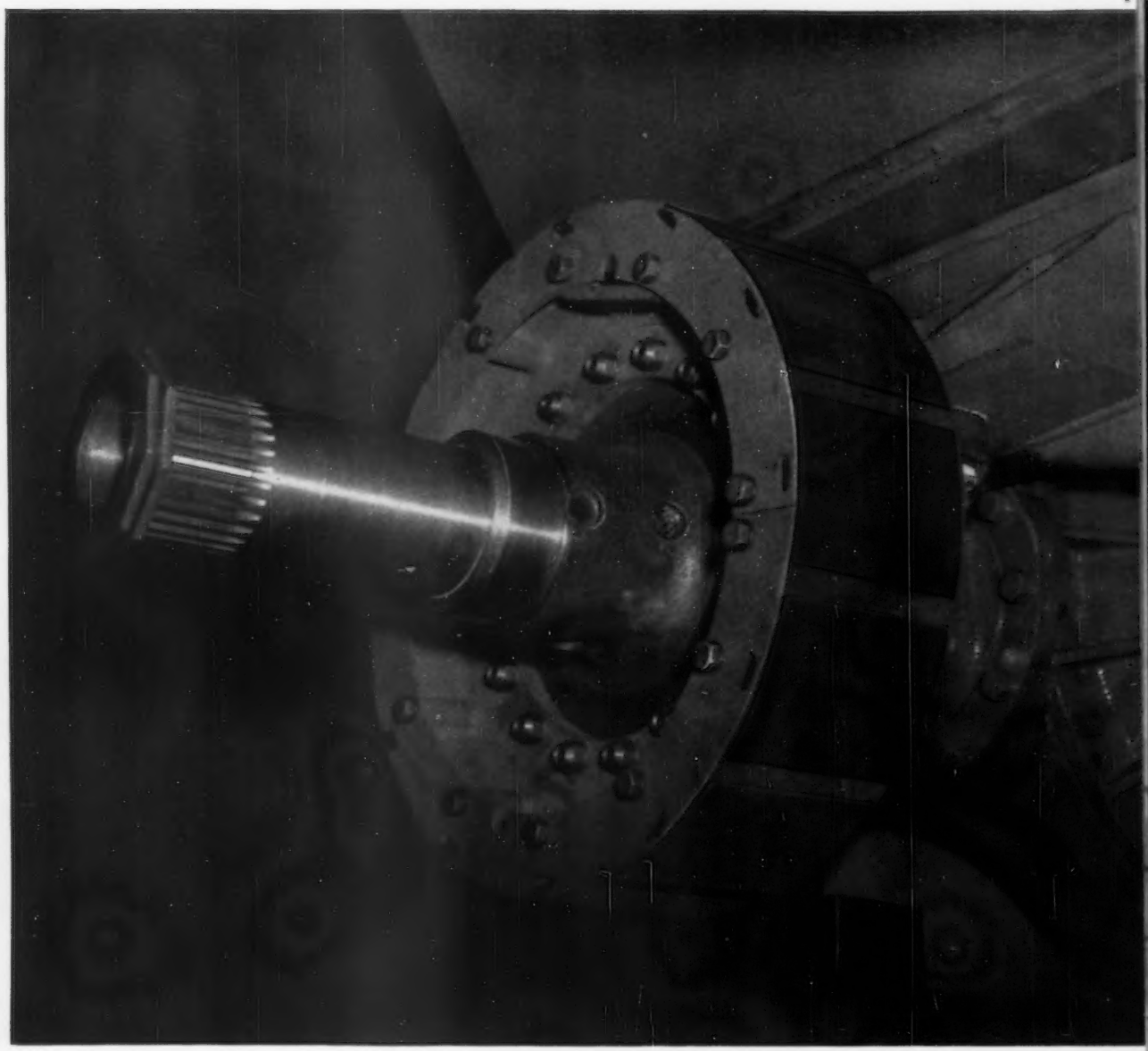
58-54

ASARCO

New B. F. Goodrich Hi-Torque Brake

THE FIRST AND ONLY WITH FULL-CIRCLE



B.F.Goodrich

OFF-ROAD BRAKE STOPPING POWER

For years B.F.Goodrich wheels and brakes have been landing big commercial and military aircraft. Now, adapting successful engineering design to the heavy duty equipment field, B.F.Goodrich has developed an off-road brake that outperforms other brakes in every case.

It's the B.F.Goodrich Hi-Torque Brake, the *only* off-road brake with reserve capacity to handle the needs of larger and larger equipment. Unlike conventional anchored-shoe brakes that are actuated at only two points, the B.F.Goodrich Hi-Torque Brake actuates with uniform hydraulic pressure under each of *12* shoes.

On-job tests prove that the B.F.Goodrich Hi-Torque stops mammoth equipment up to two and a half times faster than ordinary two-shoe brakes. Operators can reduce cycle time by maintaining higher speeds with safety. In addition, automatic adjustment is provided throughout the life of the linings. Full circle actuation allows shoes to follow drum eccentricities. This equalizes lining pressure—makes braking action smoother—reduces fade. And torque is equal in forward or reverse.

If you build or use trucks, tractors, scrapers or any wheeled off-road vehicles, you'll want to know more about this revolutionary new B.F.Goodrich Hi-Torque brake. It installs quickly, easily—requires only a single hydraulic connection. No lubrication necessary.

Free descriptive folder—The B.F.Goodrich Hi-Torque Brake—gives actual on-job test results and specifications of typical sizes up to 26" x 7" with torque capacities exceeding 120,000 pound-feet. Write: B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Troy, Ohio.

The B.F.Goodrich Hi-Torque Brake is now standard equipment on the M-R-S 250 Scraper (left) and 550 horsepower M-R-S 250 Tractor, the world's largest rubber tired scraper combination with a capacity of 34 cu. yds. struck and 43.5 cu. yds. heaped. Designed for use with straight hydraulic or air-over-hydraulic systems, the B.F.Goodrich Hi-Torque Brake is already available on other off-road equipment.

B.F.Goodrich Hi-Torque brakes

Now from FORD

New Ford C-1000 with the 260-hp. 477 Super Duty V-8 engine. Maximum GVW 31,000 lb., GCW 65,000 lb.

New Ford T-850, choice of 3 engines. Choice of 2 bogies, up to 45,000 lb. GVW and 70,000 lb. GCW.

New Ford F-1100 with the 277-hp. 534 Super Duty V-8 engine. Maximum GVW 36,000 lb., GCW 65,000 lb.

AMERICAN BUSINESS BUYS MORE FORD TRUCKS THAN ANY OTHER MAKE!

engines up to 534 cu. in...

Biggest truck engines ever built by Ford! Three all-new, Super Duty V-8's designed to stand up and deliver on America's toughest truck runs. 401-, 477- and 534-cu. in. displacements. Up to 277 hp.! Ten all-new extra heavy duty truck series rated up to 75,000 lb. GCW.

Perhaps the biggest news about Ford's all-new Super Duty V-8's is not their bigness . . . not their tremendous power output. The big story may well be in the many durability advancements, offered in the most rugged, most dependable Ford Truck engines ever built.

For instance, materials developed for the missile program are used in parts such as valve stem oil seals. Oil filters are of the same type used in commercial aircraft. The traditional exhaust-heated intake manifold is replaced by a new water-jacketed induction system. Submerged-type electric fuel pumps virtually banish vapor lock. Head gaskets are of heat-resistant stainless steel. Two compression rings and the oil control ring are chrome-plated for longer wear. A 50-amp. alternator replaces the generator as standard equipment.

These are but a few of the many advancements you'll find in Ford's thoroughly tested all-truck Super Duty V-8's for 1958. Tested in dynamometer laboratories, tested on the proving grounds, tested in commercial fleets from coast to coast . . . these new Ford V-8's, products of over six years of engineering development, are now ready to serve you.

Get in touch with your Ford Dealer for complete data on the three all-new Super Duty V-8's, and the *ten* all-new Extra Heavy Duty truck series, including tandems up to 51,000-lb. GVW, 75,000-lb. GCW, single-axle trucks up to 36,000-lb. GVW, 65,000-lb. GCW.

NEW! Three all-new engines—*401* cu. in. V-8 develops 226 hp., 350 lbs.-ft. torque . . . *477* cu. in. V-8 develops 260 hp., 430 lbs.-ft. torque . . . *534* cu. in. V-8 develops 277 hp., 490 lbs.-ft. torque.

NEW! Water-jacketed induction system contributes to maximum power output with excellent economy by providing more positive temperature control of fuel-air mixtures.

NEW! Fully machined combustion chambers and Turbulence-top pistons provide more accurate compression control and greater fuel-air turbulence, for top performance with regular grade fuel.

NEW! Submerged-type electric fuel pump virtually eliminates vapor lock. Pump delivers only solid fuel, always under pressure, operates independently of engine speed.

NEW! Valve seat inserts for intake as well as exhaust valves. Intake valves are hard-faced dished-type. Exhaust valves are sodium-cooled, faced with tungsten-cobalt.

NEW! Three-stage cooling system with separate temperature control for block and head, shortens engine warm-up time.

Big truck built...
Big truck powered...
At Ford's low prices!

FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN...
LAST LONGER, TOO!

Republic's Certified-Strength Roof Bolts

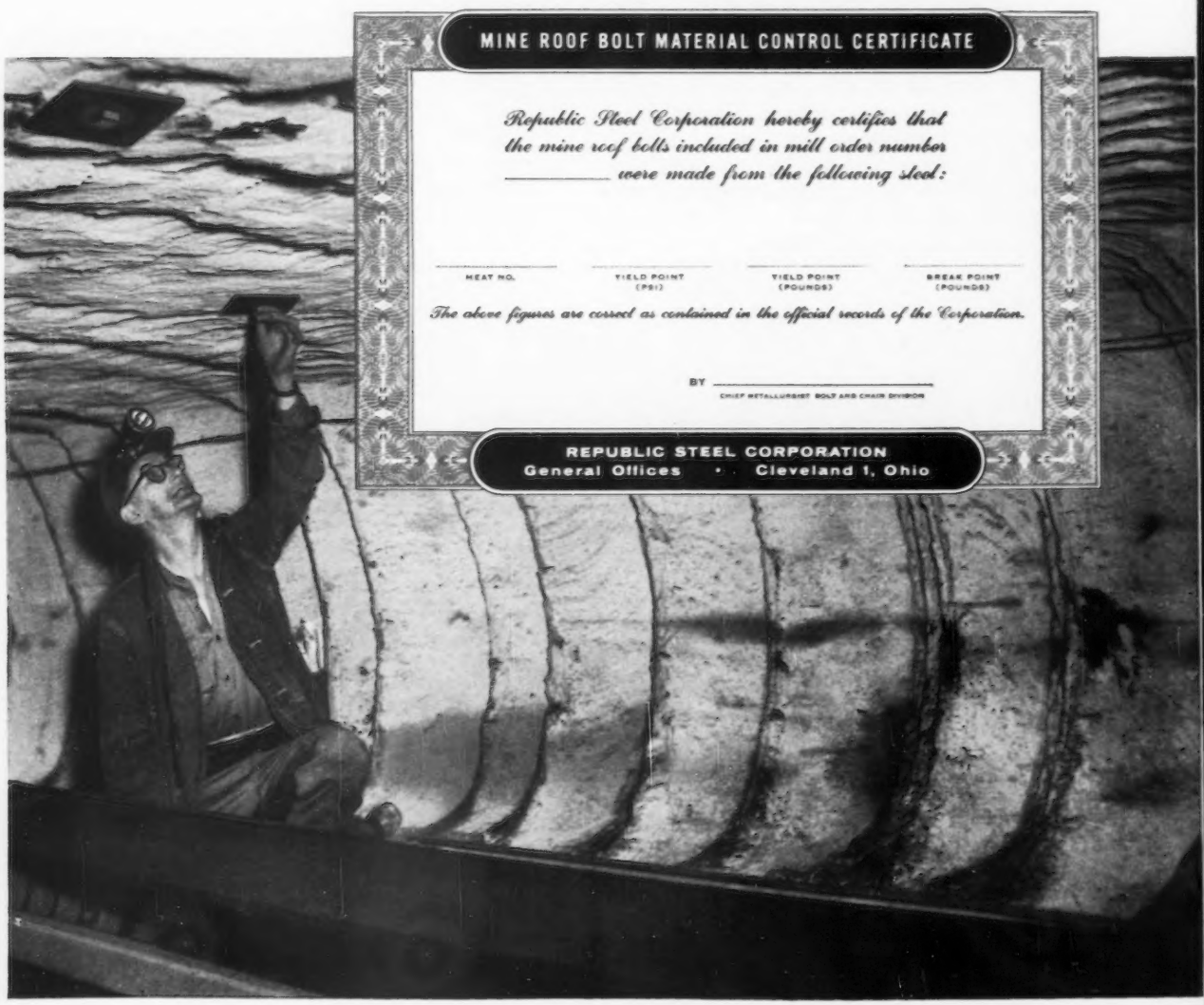
underwrite roof-control reliability

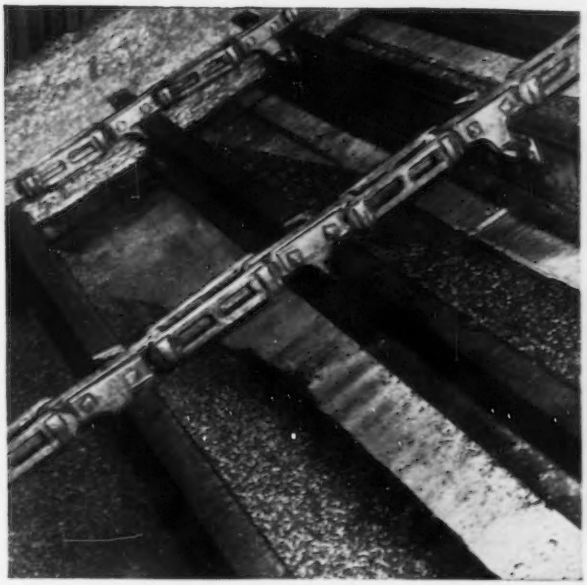
Bolted-roof reliability is made up of many factors —pattern, method of placement, type of strata— to name a few. But behind them all stands the strength of the bolt. That's why it pays to specify certified-strength Republic Roof Bolts, for full assurance of uniform top-holding power.

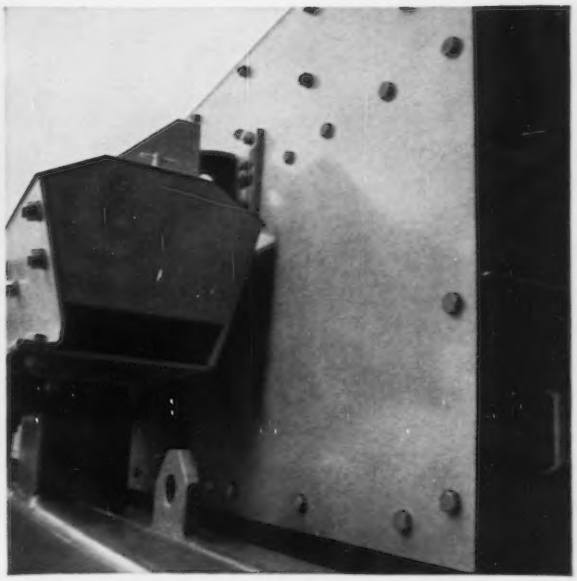
Republic is able to offer this extra measure of protection through integrated manufacturing control, from mining and blending of ores to final production of complete roof bolt assemblies. Each heat of steel destined for roof bolt use is regulated to provide required physical properties. Samples are tested to destruction to determine actual performance. Finally, each heat is kept separate so that finished bolts can be exactly identified.

As a result Republic is able to furnish a Material Control Certificate with every roof bolt shipment showing pre-tested performance, *guaranteed to meet or exceed the suggested mining standards contained in Specification ASTMA-306.* Moreover, this priceless assurance is yours, at no extra cost!

For full information on exclusive certified-strength Republic Roof Bolts, contact your local Republic office. Or mail coupon.


MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE
Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:
HEAT NO.
YIELD POINT (PSI)
YIELD POINT (POUNDS)
BREAK POINT (POUNDS)
The above figures are correct as contained in the official records of the Corporation.
BY
CHIEF METALLURGIST BOLT AND CHAIN DIVISION
REPUBLIC STEEL CORPORATION
General Offices • • Cleveland 1, Ohio





REPUBLIC HIGH STRENGTH STEEL IMPROVES SERVICE LIFE for many types of mining equipment. In the bottom of this drag-type, cleaning plant conveyor, for example, it provides excellent resistance to abrasion and corrosion. Far less frequent replacement is required as compared with a bottom made of ordinary carbon steel. Republic High Strength is also well suited to mine car and other mobile equipment use. Its high strength-to-weight ratio allows use of lighter gages. Dead weight is correspondingly reduced. Mail coupon for details.

REPUBLIC CAP SCREWS PROTECT PERFORMANCE of Ty-Rock Vibrating Screens, built by the W. S. Tyler Co., Cleveland, Ohio. Used for final assembly of major components, fine-thread cap screws of several steel analyses enable Tyler to distribute loads better and eliminate danger of fatigue failure due to vibration and cyclic loading. Republic Cap Screws are available in Hex Head, Flat Head and Fillister Head Types in a wide range of sizes, with fine or coarse threads. For full information on analyses and other data, send coupon.

RELIABILITY PLUS ECONOMY are two major advantages you secure when you specify Republic's new Truscon Steel "Budget Buildings" to solve housing problems. Ideal for hoist houses, control and equipment shelters, office and personnel use, "Budget Buildings" are easy to erect, dismantle and re-erect to meet changing needs. They are available for immediate delivery in 32-, 36-, 40-, 44- and 48-foot widths—12- and 14-foot heights—and any required length. Fully galvanized, they need no painting. One order delivers a complete package—all roofing, siding, windows, doors and hardware included. Send coupon for facts.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. C-5153
3238 EAST 45TH STREET • CLEVELAND 27, OHIO

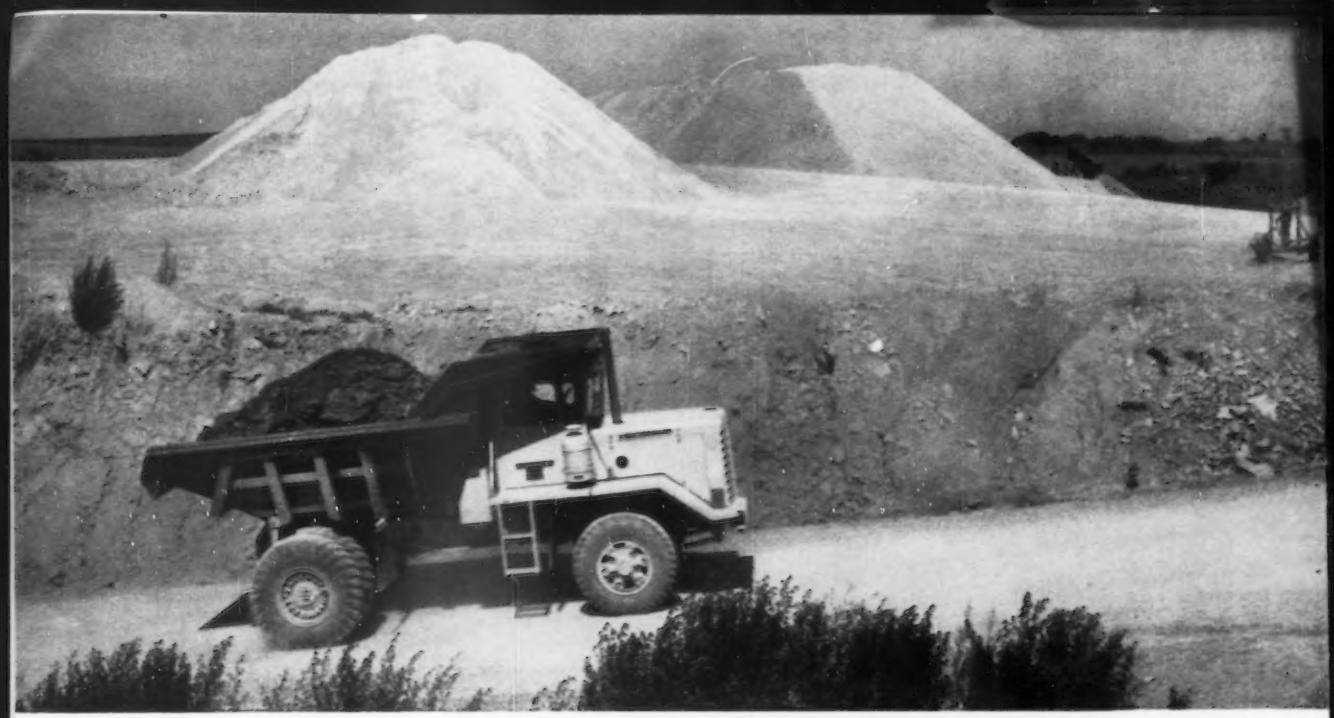
Please send information on:
☐ Mine Roof Bolts ☐ High Strength Steel
☐ Cap Screws ☐ Truscon "Budget Buildings"

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____



Out of the pit with 18-tons of shovel-loaded limestone comes the "65" Payhauler owned by Lee Crawford Quarry Co., Cedar Rapids, Iowa. The 1,200-foot haul includes a 400-foot 15% grade. The "65" was chosen on competitive demonstration.

"65" Payhauler® beats two competitors on tough, 50-hour demonstration

—for Lee Crawford Quarry Co., Cedar Rapids, Iowa

Veteran quarryman Lee Crawford invited three makes of off-highway haulers to go into his pit and "roll up their sleeves." He wanted hauling that could match the crushing efficiency of his newly-equipped plant which is as nearly perfect as could be built.

One make of hauler could not match crusher capacity. Another kept the monkey wrenches busy. Winner of the 50-hour test: the International "65" Payhauler!

"Perfect Payhauler performance made our choice easy," states Plant Superintendent Kenneth Mercer. "The '65' hauled bigger loads easily up the 15% grade out of the pit. It dumped cleaner, and up to three times faster—and got away faster for shortest cycle time.

"With the '65', we have achieved our plant efficiency goal."

Try the exclusive high reverse and "zip-around" power steering—that give 18-ton "65" or 24-ton "95" regular pick-up truck spotting ease. Measure capacity-adding Payhauler get-away speed—and the fuel economy of its load-matched, turbo-charged diesel power. Measure super-fast Payhauler dumping speed. See your International Construction Equipment Distributor for a demonstration!

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

International Harvester Company
180 North Michigan Ave.
Chicago 1, Illinois

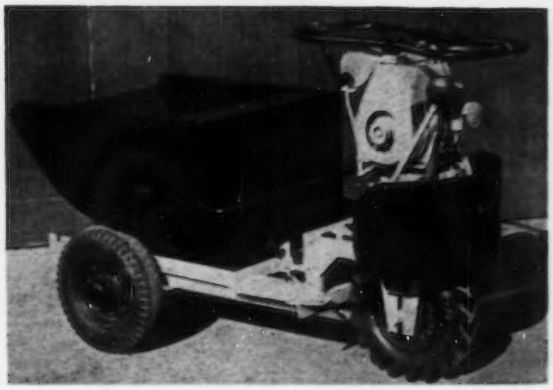
Gentlemen: Please send me a free copy of the new, fully-illustrated Payhauler catalog (Form CR-603-G).

Name_____

Street Address_____

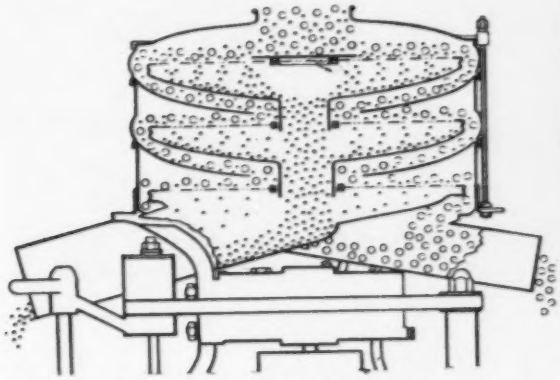
City_____ State_____

E&MJ NEW PRODUCTS DIGEST



Dumper Truck Holds Eight Cubic Feet Payload (1)

Wrigley Dumper Truck is driven by Villiers Mark XII four-stroke gasoline engine. Wheelbase is 38 in. Over-all height is 41 in. Wessex Industries (Poole) Ltd. says that electric as well as gasoline dumpers are available.

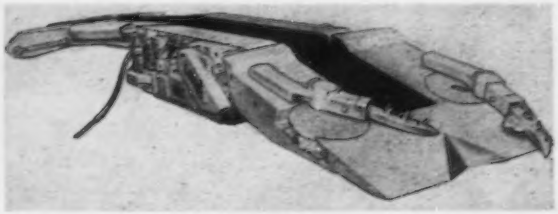


Cascade Screen Has High Throughput (2)

Cascade screen consists of three superimposed annular mesh surfaces which are subject to gyratory vibrations, causing the feed to follow a spiral path over each screen in turn. Total cloth area is 6½ sq ft. Russell Constructions Ltd. says that the machine will not blind or clog under normal circumstances. Stationary or portable models are available. One to three products can be obtained on wet or dry feed.

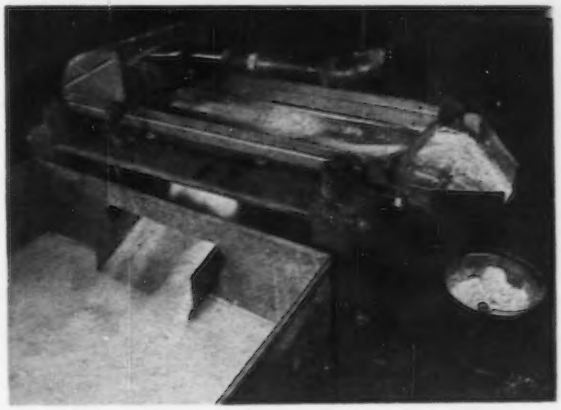
Indicator Prevents Slack Rope on Hoists (3)

McPhar Slack Rope Indicator prevents rope kinks. Whenever the safety dogs on a cage or skip engage, a clear audible signal warns the hoistman that the rope is slack. Device saves rope, time and equipment, and may prevent an accident. McPhar Manufacturing Ltd.



Loader Has Four-Ton-Per-Minute Capacity (4)

Designated the 188-C, Long Co.'s new loader has a rated capacity of 4 to 6 tons per minute and a tramming speed of 96 fpm. Single 40 hp electric motor drives all machine operations. Operating height is 25¾ in.



Small Screen Treats Ton Per Hour on 80 Mesh (5)

Mark III Russell Separator measures 21x58 in. with a total cloth area of 1218 sq in. Screen gyrates at 2100 rpm at the flywheel. At one project, a Mark III is filtering 20,000 gph through 100 mesh. Machine will operate effectively down to 200 mesh. Russell Constructions Ltd.

Blast Holer Cuts To 300 Feet Per Shift (6)

Portadrill, Model 105TA, has a rated capacity of 300 to 400 ft of 9-in. hole per shift through sandstone, shale, limestone and other similar formations using standard roller cone bits. Unit is mounted on an Eimco 105 diesel tractor, says Winter-Weiss Co.

Metal and Mineral Processing Equipment Literature

Syntron Co. has available a condensed catalog (no. 5712) covering all products in the company line. **(53)**

Morse Bros. Machinery Co. bulletin No. 574 covers machinery for the concentration and flotation of metallic and nonmetallic ores and minerals. 8pp. **(54)**

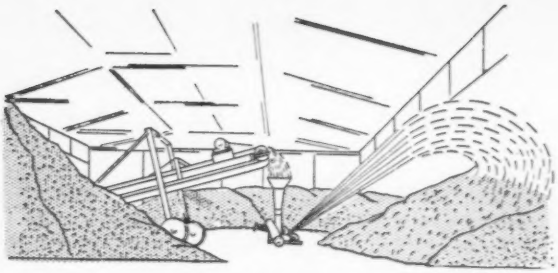
Rake classifiers—the Morse Trueline and Hydrosizer—are illustrated in 8-page bulletin No. 577 from Morse Bros. Machinery Co. **(55)**

Bulletin No. 579 from Morse Bros. Machinery illustrates in four pages the Morse line of feeders, screens, crushing rolls, gates, pumps and jigs. **(56)**

Lapp chemical porcelain valves, pipe, fittings and tower auxiliaries are covered in bulletin No. 438. Lapp Process Equipment Div., Lapp Insulator Co. **(57)**

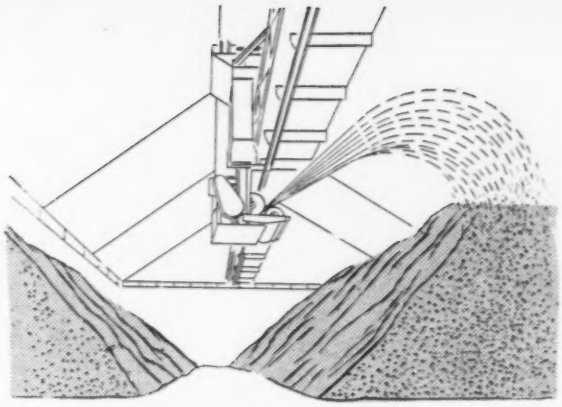
The care and feeding of mixers, a 36-page report prepared by Mixing Equipment Co., Inc., shows how to install, operate and maintain the Lightning line of mixing equipment. Illustrated. **(58)**

Continuous extraction in a multistage mixer column, a 10-page article written by Mixing Equipment Co., Inc. sponsored staff and reprinted from *Chemical Engineering Progress,* is well illustrated and a detailed account of the unit process. It might be of interest to those doing solvent extraction. **(59)**



Link-Belt Jetslinger Stockpiles Up to 35 Ft (7)

Link-Belt News for December 1957 gives considerable space to Jetslinger installations in the sugar, grain, fertilizer and shipping fields as well as mining. Under certain conditions, the slinger can be used to stack material to a height of 35 ft, or to throw material a distance of 90 ft. Several years ago, we saw a similar device being used to convey and pile overburden from an open pit in Florida's phosphate operations. Units have capacities up to 700 tph, based on material weighing 50 lb per cubic ft. Jetslinger can be used to extend the stockpile limit, to get distance or height, to load box cars, etc.



Diamond Core Drill (9)

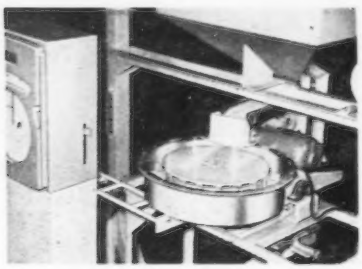
Called the Super Scout by Diamond Drill Contracting Co., this unit can drill 60 ft in hard formations, and up to 100 ft in hard formations, and up to 100 ft most cases with 90% core recovery. Drill includes a 2hp piston type air motor, water swivel, chuck, and 10 ft each of water and air hose complete with valves.

To Weigh Cars And Trucks (8)

New series of strain gage load cells for electrically weighing stationary or moving loads has been developed by Cox & Stevens Electronic Scale Div., Revere Corp. of America. Units are available in nine capacities ranging from 500 to 200,000 lb.

Sand Drilling Rig (10)

Carpco Mfg., Inc. has available two models of their beach sand exploration drilling and sampling rig—Model DR-1500 and DR165. DR1500 is mounted on a 1½ ton 4x4 truck equipped with front end winch and power takeoff. Drill operates by jet piercing with high velocity water stream that cuts down hole through the sand. DR165 is a plot or pilot drill rig on a skid mount. It can be carried on a 6x6 truck having 12 to 14 ft bed length.

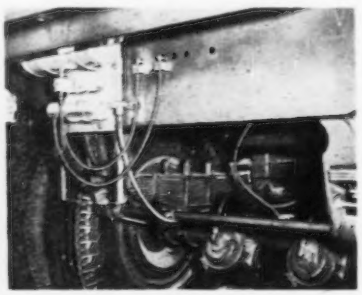


Weigh On The Run (11)

Stephens-Adamson Mfg. Co. has developed a continuous weighing and recording device that will indicate material flow in lb/min, lb/hr or tph on a 24-hour basis. Unit may be used with any type of conveying or feeding equipment.

Rotary Drill (12)

Truck-mounted rotary drill announced by Davey Compressor Co. is designed for air or mud drilling in both rock and sedimentary formations. Model M-7WA can exceed 3500 ft with 2⅞ in. pipe, and 2500 ft with 3½ in. pipe.



Centralized Lubrication (13)

Alemite Div., Stewart-Warner Corp. is introducing a midget size Accumite centralized lubrication system for low pressure positive displacement type lubrication of machinery. Low cost, metered discharge and ease of installation are cited among its advantages.

Gondola Unloader (15)

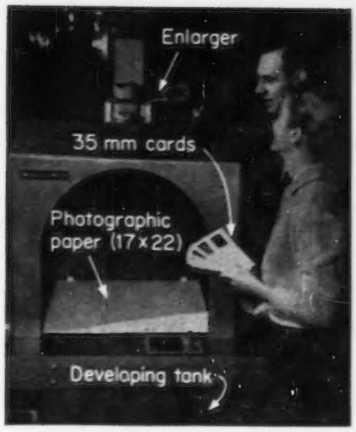
M-H Standard Corp. says that their salt car unloader can unload a two-compartment 40-ton gondola or hopper car in 5 hours. Unit is driven by ¾hp totally enclosed gearmotor.

Car Retarders (16)

Union Switch & Signal has installed their electro-pneumatic car retarding system in more than 25 railroad and docking yards in the U.S. Retarders hold cars until they are needed at loading points, then feed them into the pocket as called for.

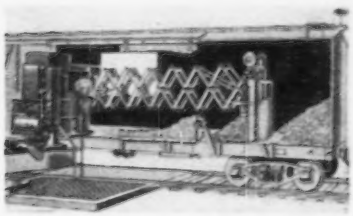
Rock Drill Lubricant (17)

D-A Lubricant Co., Inc. has designated two new lubricants as D-A Rock Drill Lubricant and D-A Rock Drill 500. First mentioned is for all rock drills and is satisfactory for both summer and winter use according to the company.



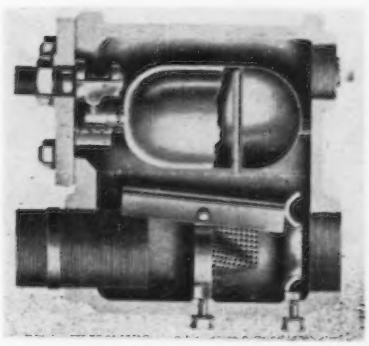
Protect Original Drawings (14)

On-the-spot reproduction of microfilmed engineering drawing for use or reference purposes can be made at low cost on a new microfilm producer-reader-enlarging duplicator process developed by Remington Rand Div., Sperry Rand Corp. Original drawing is reduced to a 35mm negative, then inserted on a IBM-type aperture cards which can be inserted into the enlarger-duplicator to produce a 17x22 in. positive print in about one minute's time. No dark room facilities are needed on the enlarger-duplicator end of the process.



Box Car Unloader (18)

Stephens-Adamson Mfg. Co. has developed a fast, efficient hydraulically-operated box car unloader for granular, pulverized or free-flowing bulk solids. Device can unload the largest box car in less than 30 minutes. The operator stays outside the car, away from the dust.

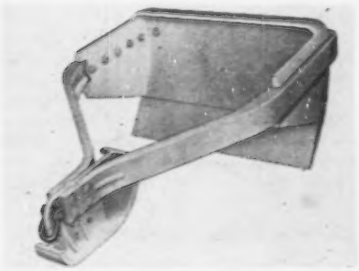


Compressed Air Separator (19)

Driair device separates condensed water and oil from compressed air, collects rust, pipe scale and sediments and delivers clean dry air to the tool, according to 4-page bulletin prepared by New Jersey Meter Co. Available in pipe sizes of ¾, 1 and 2 in.

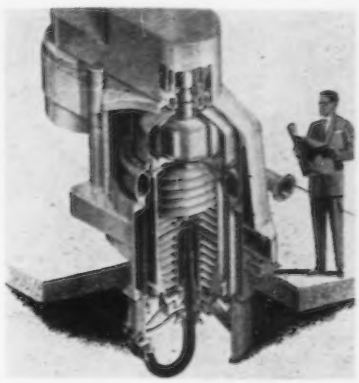
Measure Air Consumption (20)

New Jersey Meter Co.'s Tool-om-eter and Drill-om-eter are said to give accurate information on air consumption. Jersey Meter says that the tool will help you pick the right tool or drill and keep it in proper maintenance.



Slushing Scrapers (21)

Heavy-duty, hardened alloy steel Superior scrapers are available in sizes ranging from 36 to 84 in. for use with slushers from 10 to 150 hp. New Design has many advantages, says Thompson-Berg Co.



Continuous Centrifugals (22)

Super-D-canters are available in both horizontal and vertical (above) design for filtering or decantation at up to 150 psi. Will handle particle sizes under a half inch down to a few microns, according to Sharples Corp.

Earthmoving Equipment

A 56-ton, 335hp trailer-type bottom dumper, the Coalhauler Model 95, has been introduced by Construction Equipment Div., International Harvester Co. Capacity is 70 cubic yd struck. **(24)**

Two new tractors—a crawler and a wheel-type—and several new items of matching equipment have been released by John Deere Industrial Div., Deere & Co. Series 440 tractors have clutch-type direction reverser as optional equipment. Engine is 30hp. **(25)**

Giant rubber tire bags, each capable of holding 500 gal of fuel, were designed for the Army by Four Wheel Drive Auto Co. for use on the Army Teracruzer which can carry 5,000 gal of fuel. **(26)**

Ford Motor Co. will conduct one week, on-the-road courses to teach fleet truck drivers how to drive safely. **(27)**

Yale & Towne Mfg. Co. are manufacturing a 4-cubic yd Model 404 Trojan tractor shovel. Unit is 4-wheel drive, rubber tired. Dumping clearance is 10½ ft under the cutting edge. **(28)**

Model 200, 4-wheel drive tractor shovel in 2½ cubic yd capacity is available from N. P. Nelson Iron Works, and is powered by 117hp gas or diesel. **(29)**

Caterpillar Tractor Co. displayed two new items at recent National Crushed Stone Association show. One item was a Cat D337 Series F electrical and mechanical drive unit to supply power to portable crushing plants. Second item was the Gyrodozer, a No. 7G Bulldozer with a tilting blade and four cutting teeth. **(30)**

Full Catalogs For Limited Circulation to Engineering Offices and Purchasing Agents—Write Direct to Manufacturer

Mission Manufacturing Co. catalog 57-58 covers complete line of oil field pumps, parts and valves, some of which may be of interest to mining and metallurgical engineers. 117pp. Price list. Mission Manufacturing Co., P.O. Box 4209a, Houston, Tex.

Taylor Instrument Companies' catalog on instruments for the process industries —indicating, recording and controlling contains 17 separate tab index labels. Price list is included. Taylor Instrument Companies, Rochester 1, N. Y.

Mine Safety Appliance Co. catalog 7-B lists and illustrates every item in the company line of safety aids. Price list included. Mine Safety Appliance Co., 201 North Braddock Ave., Pittsburgh 8, Pa.

Foote Brothers Gear & Machine Corp. catalog includes gear reducers, gear motors, speed reducers, worm gears, helical gears, flexible gears, lubrication data and engineering information. Foote Brothers Gear & Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill.

Victaulic Pipe Tools (31)

Two new compact, portable tools that roll grooves into lightweight pipe and tubing without removing metal are available from Victaulic Company of America. Tools adjust from 1¼ in. through 12 in. diameters.

Handy Fact Finders

Union Asbestos & Rubber Co. has a pipe insulation slide fact finder that tells statistics needed to choose proper insulation for pipe whose temperature ranges from 300 to 1,200 deg. F. **(32)**

Stokes Corp. is distributing a vacuum calculator fact finder calibrated to show what pumping capacity is needed with Stokes equipment to obain any desired vacuum. Select list of conversion tables, boiling and melting points included. **(33)**

To Clean Filter Cloth (34)

Versene, Dow Chemical's filter cloth regenerating cleaning solution, was tried in one western uranium mill where it was necessary to change filter cloth every 10 to 15 days at a cost of $300 per filter bank. Operator used Versene to clean the cloth every 10 to 15 days, extending the cloth life five-fold. Cost of the cleaning operation was $60 per filter bank.

New Uses For Chelates (35)

Did you ever consider using chelating agents to tie up an undesirable metallic ion in solution, or to remove metals from solution, or to concentrate and recover dissolved metals? Dow Chemical now offers 15 chelating agents. Chelates have affinity for certain metals and their reaction is reversible. Versene (item No. 34 above is one of these versatile chelating agents). They have applications in analytical chemistry and in removing boiler scale.

All Purpose Belting (36)

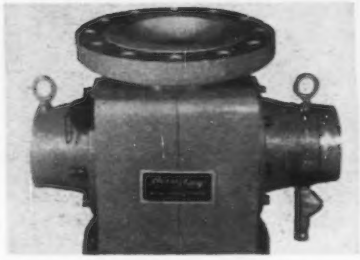
Rilfex, developed by Rubber Improvement Ltd., and approved by British Coal Board for its anti-static and fire resistant properties, is built on a foundation of Teryene polyester fiber and coated with PVC, according to the company. Rubber Improvement also makes brattice cloth, conveyor belting, ventilation tubing and cable hanging straps.

Flocculating Agent (37)

Polyox, a high-molecular weight grade of water soluble resins, is available from Union Carbide Chemicals Co. as a white, crystalline granule. Flocculant is available for use over a wide range of pH.

Silicone Rubber (38)

Dow Corning Corp. has developed a shape-it-yourself rubber that can be applied and vulcanized at room temperatures. Called Silastic RTV 501, the compound comes in two packages, to be blended prior to use.

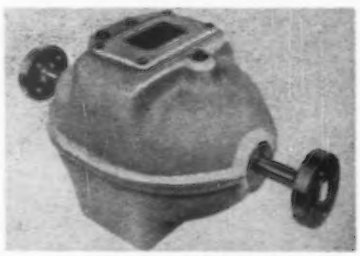


Density Measuring Unit (39)

An Accuray Density System which measures and/or controls fluid density, specific gravity and per cent solids has been developed by Industrial Nucleonics Corp. Applicable for liquids, slurries and bulk solids, the unit measures by means of a gamma ray emitting isotope. Available in pipe sizes from 3 to 8 in. from stock; other sizes on special order.

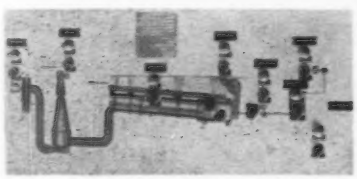
Convey With Air (40)

Dry, fine bulk material can be conveyed horizontally without moving parts using Fuller Co.'s Airslide Conveyor. Working model shown above was demonstrated at recent chemical industry show. Motion is imparted to particles by air blast up through porous conveyor fabric, much as air is blown through the canvas bottom of a Callou cell.



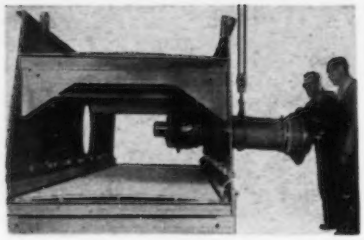
Magnetic Flow Meter (41)

Transmitter unit consist of a Teflon-insulated nonmagnetic flow tube containing flush-mounted metallic electrodes and surrounded by an ac electromagnet. When a conductive liquid passes through the tube, a current is induced and measured in proportion to rate of flow. Rates as low as 3 gpm can be measured. Available to fit ½ and 1 in. pipe from Foxboro Co.



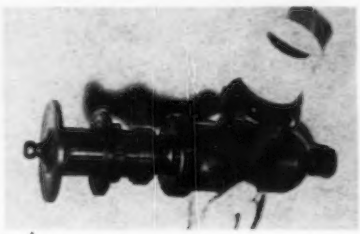
Schematic Panel Board (42)

Standard Steel Corp. engineers designed a graphic control board for automatic operation of a Standard-Hersey rotary dryer to be installed in Cuba. Diagram shows the flow of all process materials and the location of motors and burner.



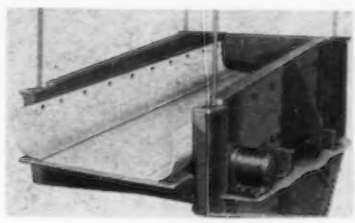
Vibrating Screens (43)

Standard twin-bearing vibrating screens are offered by Screen Equipment Co. in single or double deck 3x6 to 6x6 ft and in triple deck 3x6 and 6x12 ft sizes.



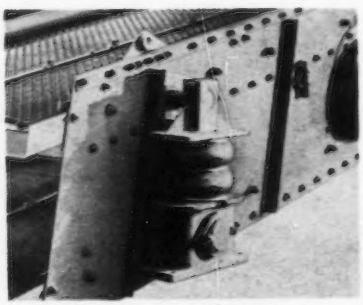
Plastic Sink Trap (44)

American Agile Corp. offers a sink trap fabricated from polyethylene designed for quick, easy assembly with a threaded outlet drain measuring 1½ in. Can be equipped with 1½ or 2 in. flanges for use with any type of drain.



Vibrating Feeder (45)

Designed by Allis-Chalmers Mfg. Co. to handle sticky material, new 4x9 ft Low-Head feeders are handling 150 tph or run of mine Michigan iron ore at 10 to 16% moisture.



Air Springs For Screens (46)

Allis-Chalmers just announced the introduction of air springs for its line of vibrating screens that will isolate 98% of the vibration. One size will accommodate a wide range of A-C screen sizes.

For More Details on New Product Items Starting on p 45 and For Copies of Free Literature Listed Below—Circle the Proper Number on Card. Be sure to Give Your Name and Address, Then Mail to *E&MJ*

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Earthmoving

MAJOR ADVANCES in the design of Allis-Chalmers HD-21 turbocharged diesel tractor are described in 16-page bulletin-catalog (MS-1243). **(61)**

CENTRALIZED lubrication system planning data is the subject of Alemite Div., Stewart-Warner Corp.'s 12-page release. **(62)**

BOWL SCRAPER, Model TS-24, by Euclid Div., General Motors Corp., contains an excellent performance chart on p 16. 24pp. **(63)**

TITLE of Detroit Diesel's 16-page booklet on how to pick a fuel oil is "Fuel Oil and High RPM Diesel Engines." **(64)**

MAINTENANCE guide for Caterpillar No. 933, 955 and 977 Traxcavators has been prepared especially for operators. 30pp. **(65)**

HAULAGE locomotives, Type 201 and 202, are described in Goodman Mfg. Co. 4-page bulletin. **(66)**

Auxiliary Aids

FIVE types of heating cable, their applications and installation, are covered in General Electric's bulletin No. 19-457. 9pp. **(67)**

TWO bulletins dealing with liquid rheostats are now available from General Electric Co. **(68)**

FEEDER safety switch, for interrupting 2000 to 3000 amp loads, is illustrated in Ohio Brass literature. **(69)**

V-BELT testing, inspection and control booklet by Goodyear Tire & Rubber Co. shows how belts are made in 16pp. Booklet S-51107. **(70)**

CONTROL mechanism for use with woven wire belts is illustrated in Knapp Mills, Inc. literature. Device is the patented "Guidler." 4pp. **(71)**

SILENT CHAIN drives, Book 225, by Link-Belt Co., contains 88 pages of detailed drawings and applications. Selection tables cover 22 pages. **(72)**

FACILITIES available at Foote Bros. Gear & Machine Corp. are detailed in 22-page catalog. **(73)**

CORROSION resistant wrought iron conduit, developed by National Electric Products Corp., is described in 8 pages. **(74)**

DIAPHRAGM seals designed to protect pressure instruments against corrosion and clogging are described in Brooks Rotameter Co. bulletin No. 250. 2pp. **(75)**

ANTI-OXIDANT compound for making trouble-free electrical joints is detailed on 2-page release from Hi-Voltage Equipment Co. **(76)**

HELIWELD equipment catalog, revised by Air Reduction Sales Co., is 24 pages. **(77)**

MECHANICAL power transmission and conveying machinery, developed by Chain Belt Co., are illustrated in catalog No. 610. Includes two page selection chart. **(78)**

FLEXIBLE COUPLING bulletin prepared by T. B. Wood's Son's Co. details their patented Sure-Flex coupling in 8pp. **(79)**

FLEXIBLE LINK SHAFT is available in all sizes and unlimited lengths, according to Clark Flexible Link Shaft Co., and is described in 6-page bulletin. **(80)**

AUTOMATIC irreversible controls that can be attached to any machine where friction-locking devices fail to hold desired position are available from Reid Metal Products, Inc. Shear-action locking device was developed originally for aircraft throttle control. **(81)**

Process Controls

FLUID FLOW alarms for signalling or control functions are illustrated in Brooks Rotameter Co. literature. Bulletin 165. 4pp. **(82)**

REMOTE LIQUID LEVEL indicators for boilers, heaters, tanks and process vessels are detailed in Yarway-Waring Co. bulletin No. WG 1824. 24pp. **(83)**

E&MJ NOT GOOD AFTER SEPT. 1, 1958

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled. **MARCH 1958**

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
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9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
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15	31	47	63	79	95	111
16	32	48	64	80	96	112

Name .....

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

ROTAMETERS and flow indicators are available in many sizes and types according to latest bulletin (M-1) from Schutte & Koerting Co. 4pp. **(84)**

TEMPERATURE CONTROLS, a complete line of differential expansion instruments is available according to Burling Instruments Co., Inc. literature. **(85)**

METERS and controls to transmit, record, indicate and control, are presented in Bailey Meter Co.'s catalog-bulletin. 8pp. **(86)**

Dust & Fume Control

FUME SCRUBBERS, in the U.S. Stoneware Cross-Flow design, are available in capacities from 3,000 to 32,000 cfm, according to 4-page bulletin. **(87)**

REDESIGNED CYCOIL oil bath aftercleaner from American Air Filter Co., Inc. is illustrated in 8-page bulletin. **(88)**

CONDENSED general catalog on Wheelabrator Corp.'s entire line of dust collecting equipment is now available. 32pp. No. 951-D. **(89)**

INDUSTRIAL dust control is the title of W. W. Sly Mfg. Co. bulletin No. 104. 35pp. **(90)**

SIX-PAGE bulletin on dust collecting equipment is now offered by Ducon Co. **(91)**

INDUSTRIAL dust control, using the Day Co. Type RJ dust filter, is the subject of an 8-page bulletin No. G-579. **(92)**

Process Filters

ROTOBELT FILTER, a new tool in mineral beneficiation, a paper presented at 1957 AIME meeting, is now available from Eimco Corp. Illustrated and mimeographed in 24pp. **(93)**

CONTINUOUS rotary drum filter, the Bird-Young machine, is described in Bird Machine Co. bulletin. 7pp. **(94)**

CONTINUOUS vacuum drum and disc filters in the Morse Bros. Machinery new line are detailed in 8-page catalog-bulletin. **(95)**

VERTICAL LEAF PRESSURE filters for liquid clarification and solids recovery are presented in Niagara Filter's 12-page catalog No. NC-457. **(96)**

CONTINUOUS centrifugals in the Tolhurst Centrifugals Div., American Machine & Metals, Inc., can be examined in 4-page bulletin. **(97)**

CHEMICAL porcelain vacuum filters, design and care, is the subject of U.S. Stoneware bulletin F-40. 12pp. **(98)**

FILTERS for water and aqueous liquids in the Fulflo line can be examined in Commercial Filters Corp. literature. 4pp. **(99)**

SUCTION leaf filters, wherein the suction is provided by the pump, are illustrated in Hercules Filter Corp. bulletin. 6pp. **(100)**

SYNTHETIC filter cloth for all types of dust collectors and filters is presented in Filtration Fabrics Div., American Machine & Metals, Inc. 6-page release. **(101)**

HORIZONTAL and vertical plate filters from Sparkler Mfg. Co. can be examined through 4-page bulletin. **(102)**

PRESSURE leaf filters and Hercules Filter Corp.'s Roto-Jet, self-cleaning unit are discussed in 16 pages. **(103)**

HYDRAULIC filter presses available from Fred S. Carver Inc. are the subject of a 6-page bulletin. **(104)**

Laboratory Aids

QUESTIONS AND ANSWERS on X-ray diffraction, diffractometry and spectrography is the title of a 13-page booklet prepared by Philips Electronics, Inc. **(105)**

INDUSTRIAL pH equipment engineered by Beckman Instruments, Inc. is illustrated in bulletin No. 5400. **(106)**

USE OF FLUORESCENT indicators in laboratory chemical analysis is the subject of *Organic Chemical Bulletin*, Vol. 29, No. 4, available from Eastman Organic Chemicals Dept., Distillation Products Industries. 4pp. **(107)**

WHAT'S NEW IN LABORATORY EQUIPMENT is the title of Scientific Glass Apparatus Co.'s supplement to their catalog (No. 31.) 20pp. **(108)**

PARTICLE size analyzer, developed and available from Mine Safety Appliances Co., is introduced in 4-page release. **(109)**

CHEMICAL porcelain laboratory sinks in the U.S. Stoneware line are illustrated in a 19-page bulletin L-8 **(110)**

Materials of Construction

NI-HARD CASTINGS, bulletin No. 263, illustrates those Ni-Hard castings available from Nordberg Manufacturing Co. **(111)**

ASME AND API code fabrications, lead-clad steel, copper and aluminum, lead and lead alloys, carbon and stainless steels, and polyvinyl chloride materials for processing equipment are detailed in Knapp Mills Inc.'s 32-page illustrated bulletin. **(112)**

Knot shown is the clove hitch, made in Plain or Reinforced Primacord and drawn tightly around the Plastic Reinforced Primacord.

Plastic Reinforced Primacord Branch Line, recommended for extremely deep holes — also river crossings and other wet conditions. Covered with a tough plastic material — waterproof and resistant to acids commonly encountered. Tensile strength 275 lbs. 1000-ft spool weighs 22 lbs.

Don't Worry... use Primacord

Why worry about stray electrical currents when you can hook-up and detonate with Primacord? It acts as the detonating agent throughout the entire column of explosives, or furnishes initiation to primers of blasting agents. This means safer, easier, quicker loading. It connects all holes. This means that you can plan your shots to obtain better fragmentation.

When your blast is loaded and hooked up, it cannot be set off by normal vibration or friction, ordinary impact or sparks, *or stray electrical currents.* Even a direct hit by lightning failed to detonate it. Primacord must be detonated with fuse and cap or electric blasting cap.

For further information see your explosives supplier or write to

THE ENSIGN-BICKFORD COMPANY
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Primacord® and Detacord® Detonating Fuse, Safety Fuse, Ignitacord®, Quarrycord®, Pyrotechnical Devices and Blasting Accessories

Hook-up and detonate with

PRIMACORD®

and guard against *Stray Current* hazards

Reinforced Primacord Trunk Line — also recommended for deep holes where normal strength and resistance to abrasion and cutting are needed. Textile reinforced (yellow with red thread), tough, resilient, flexible. Tensile strength 160 lbs. 1000-ft. spool weighs 19 lbs.

P-b

Allis-Chalmers TS-160

7 yd struck

9.5 yd heaped

155 horsepower

5 speeds to 25.4 mph

12-ton payload

Measure these advantages for

22 hp per struck yard—Big Allis-Chalmers supercharged diesel engine delivers extra lugging ability for tough pulls, fast loading. Versatile TS-160 can team up with big equipment or work alone on long- or short-haul construction jobs—handle a wide range of utility jobs, travel at speeds up to 25.4 mph.

Measure these features . . . Allis-Chalmers 516-cu-in. diesel engine—dependable power at all working speeds • Independent, constant live hydraulic power for steering and scraper operation • Low, wide bowl—8-ft, 1½-in. cutting edge . . . 3-piece, interchangeable cutting edges . . . double-acting hydraulic bowl lift jacks • Positive hydraulic ejection, high apron lift to full 7-ft, 1½-in. opening • Roomy operator's compartment, easy-to-reach controls, 24-volt direct electric starting, adjustable bucket-type seat, synchronized 4-wheel air brakes • Big push block for all types of pushers.

a wide range of earth-moving jobs...

Turns non-stop in less than 25 ft with 90-degree hydraulic steering... easy maneuverability in narrow cuts, faster cycles without reversing in tight turn-arounds.

Moves quickly from job to job... when required, transport wheels are available to meet legal load limits for highway travel.

ALLIS-CHALMERS CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

See how they work that

At this giant strip mine, the Tiger Brand Amerclad (shown in foreground below) is tortured by being dragged over razor-sharp rock and constantly pelted by flying fragments that are being blasted. It lies in the sun, rain and snow during the 24-hour workday.

Tiger Brand Amerclad

In wet or dry locations!

VERY FRANKLY, we do not make a range of Tiger Brand Amerclad qualities. When you see the Tiger Brand Amerclad mold identification on a length of portable cord or cable, you can be quite sure that nothing better can be purchased, no matter how much you want to spend for it.

The reason is that American Steel & Wire has catered strictly to the *heavy-duty* market where portable cord or cable is concerned. We're well aware that cable failure can be one of the most exasperating production difficulties that you can encounter. Expensive too, because nothing operates without power.

So the greatest care is lavished on Amerclad. Every inch of cable is vulcanized in a freshly cast lead sheath to insure a dense, tough, homogeneous sheath. Mechanical skimmers remove dross from the lead-melting pots, and the pots themselves are kept in an inert gas atmosphere to prevent formation of impurities.

The result is an amazingly tough and durable cable with precisely centered conductors that withstands mechanical abuse, water, oil, grease, gasoline, ozone, heat and cold. Ask your AS&W salesman for the story . . . and a catalog.

AMERICAN STEEL & WIRE DIVISION
United States Steel, General Offices: Cleveland, O.
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, New York

The workman is holding an electric concrete tamper that knocks the entrapped air out of the mix before it sets—giving a denser, stronger concrete. The tamper is equipped with Tiger Brand Amerclad. It's dragged through wet concrete, over piling and beams, run over by trucks. Yet the manufacturer says he has never had a complaint about the cable.

Watch the **United States Steel Hour** on TV every other Wednesday (10 p.m. Eastern time).

USS TIGER BRAND ELECTRICAL WIRE & CABLE

a standard Tiger Brand cable for every special job

- Asbestos Wire and Cable
- Mold Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

UNITED STATES STEEL

USS TRADEMARK

Moving 16,000 to 20,000 tons of

One of the biggest and most efficient stone-crushing plants on this continent is owned by The Highway Paving Company Limited of Montreal, which recently increased its capacity from over 400 tons per hour to over 1600 tons per hour.

Almost all of this operation is automatic. However, quadrupling production involved moving rock from quarry face to crusher in sufficient quantity to assure Highway Paving's booming operations of a continuous supply of crushed stone.

Seven Macks were given the job. Working under six-yard electric shovels, they shuttle from shovel to crusher, each making 10 trips an hour; the seven trucks average over 16,000 tons per day. The shovels really have to move to keep up with the hustling Macks, which are on the go 10 hours a day.

Highway Paving knows that its production of crushed stone is dependent on equipment that must maintain "the pace that kills", day after week after month, without crippling breakdowns. Their Macks

Mack being loaded by one of the six-yard electric shovels. The Macks take a brutal beating from the seven-ton impact of broken limestone dropped with each shovel pass . . . but come right back for more.

rock per 10 hour day with 7 trucks

have proved that they are worthy of this dependence. In fact, no other make of dump vehicle is used in this quarry.

Macks have everything it takes for dependable, profitable quarry, mine or construction hauling. Your nearest Mack representative will be glad to give you the names of Mack users in your area who are racking up new production records, with minimum down time and top economy. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

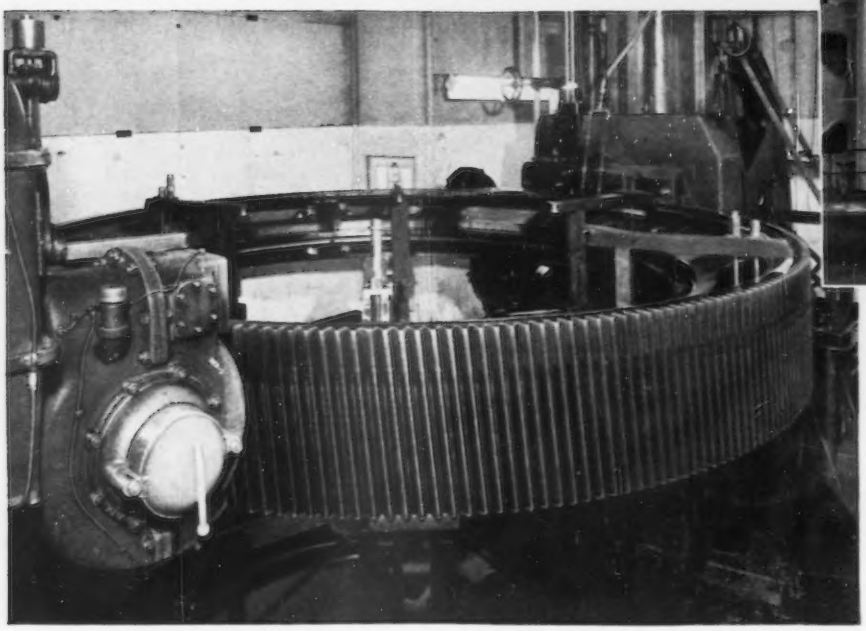
MACK
first name for
TRUCKS

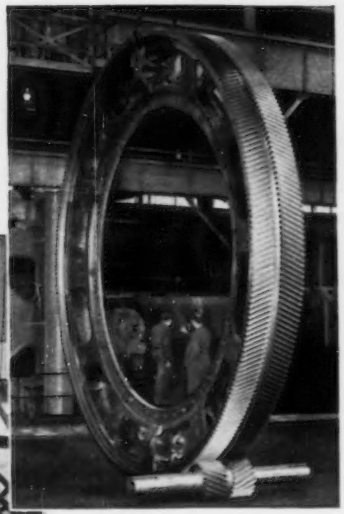
5511

Dumping rock into Highway Paving's huge crusher which is so located that trucks can dump into it from both sides. Number of loads emptied into crusher are counted electronically, and tonnage crushed is determined by belt weighing equipment.

Gears by FALK

. . . a good name in industry





ABOVE: In foreground, split ring herringbone gear, 16¾ feet in diameter. In background, a single helical gear is being rough-cut on special hobbing machine (which also can cut herringbone or spur gears).

LEFT: Split ring gear receiving final cutting on special hobbing machine, designed and built by Falk. It is operated in a temperature-controlled room to minimize dimensional variations.

Here's how MODERN GEARS can SAVE MONEY for you...

• Are you making the mistake of driving your costly mills and kilns with gears of antiquated design—or with gears made to a price, rather than to the topmost standards your operation deserves?

Falk Helical Gears are the most efficient gears (98½%) you can buy. They can bring you these substantial savings:

1 They last longer, hence reduce your over-all gear investment.

2 Pinion replacement can be sharply reduced when gears are properly proportioned and installed, and adequate lubrication and enclosures are provided.

3 They give better performance and longer life to your driving and driven machinery.

4 Their higher possible ratios permit use of higher-speed motors—a saving in motor costs and in power bills.

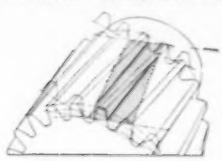
As the country's largest supplier of precision gearing, Falk is the manufacturer best equipped to *recommend without prejudice* the exact gear most suited to your specific application. Whatever type gear your job demands—single helical, herringbone or spur—Falk has unsurpassed facilities to engineer and produce it.

You are invited to contact any Falk representative—also,
write for Report 6170, "Advantages of Helical Gearing"

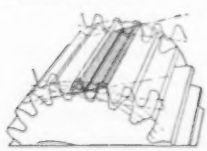
THE FALK CORPORATION, 3001 W. CANAL ST., MILWAUKEE 8, WISCONSIN

GEAR FACTS FOR ENGINEERS

The greater capacity of Falk Helical Gears, whose teeth are cut obliquely across face, is shown by the sketches below. When helical gears mesh, two or more teeth are always in contact; they share the load. Result: maximum contact area, greater capacity and strength.



By contrast, on gears with teeth cut straight across the gear face (as in spur gears), there are alternately one or two teeth in contact when gears mesh. Result: Very small contact area. The load-carrying capacity (rating) is determined by minimum contact conditions when but one tooth sustains the load.



On the basis of comparative sizes of contact areas of the two gear types, the high capacity of helical gears over competing types is apparent. Engineers, operators and maintenance men who have experienced the advantages of Falk Helical Gears are unwilling to "settle for less".

Save up to $2000

SEE and COMPARE the Case® W-9 Terraload'r before you buy

A free demonstration will quickly convince you that the new Case W-9 Terraload'r will *outperform competitive four-wheel-drive loaders costing up to $2000 more.* Main reason is the W-9 has better balance and stability to maintain traction on all four drive-wheels, when digging or traveling with heavy loads. Short, rigid lift arms — pivoted AHEAD of operator — give *better visibility, increase dumping reach, and eliminate danger of catching operator's arm in lifting mechanism.*

Like other Case industrial wheel and crawler units, the W-9 Terraload'r is sold and serviced under *one factory warranty,* by reliable Case heavy construction machinery dealers everywhere. Fifteen centralized Case industrial parts depots insure *fast delivery of parts anywhere in the U. S. and* Canada. Long-term financing and LEASE plans are also available to help you obtain *new* equipment *now* on easy monthly terms, without tying-up needed capital. Mail coupon for full details.

CASE

1st in Quality for over 100 years

Quick facts

- 1⅜ to 2¾ cu. yd. heaped capacity
- 11,000 lbs. break-out force, 5,500 lbs. carrying capacity
- Four-wheel-drive, with rear-wheel power-steering
- Power-boosting torque converter, plus full power-shift in all speed ranges, as well as forward and reverse.
- Choice of 4-cylinder valve-in-head Case diesel or gasoline engine for maximum operating economy

Clip...mail for free catalog

J. I. CASE CO., Dept. C1378, Racine, Wis., U.S.A.

☐ Send free catalog on W-9 Terraload'r

☐ Have dealer representative call

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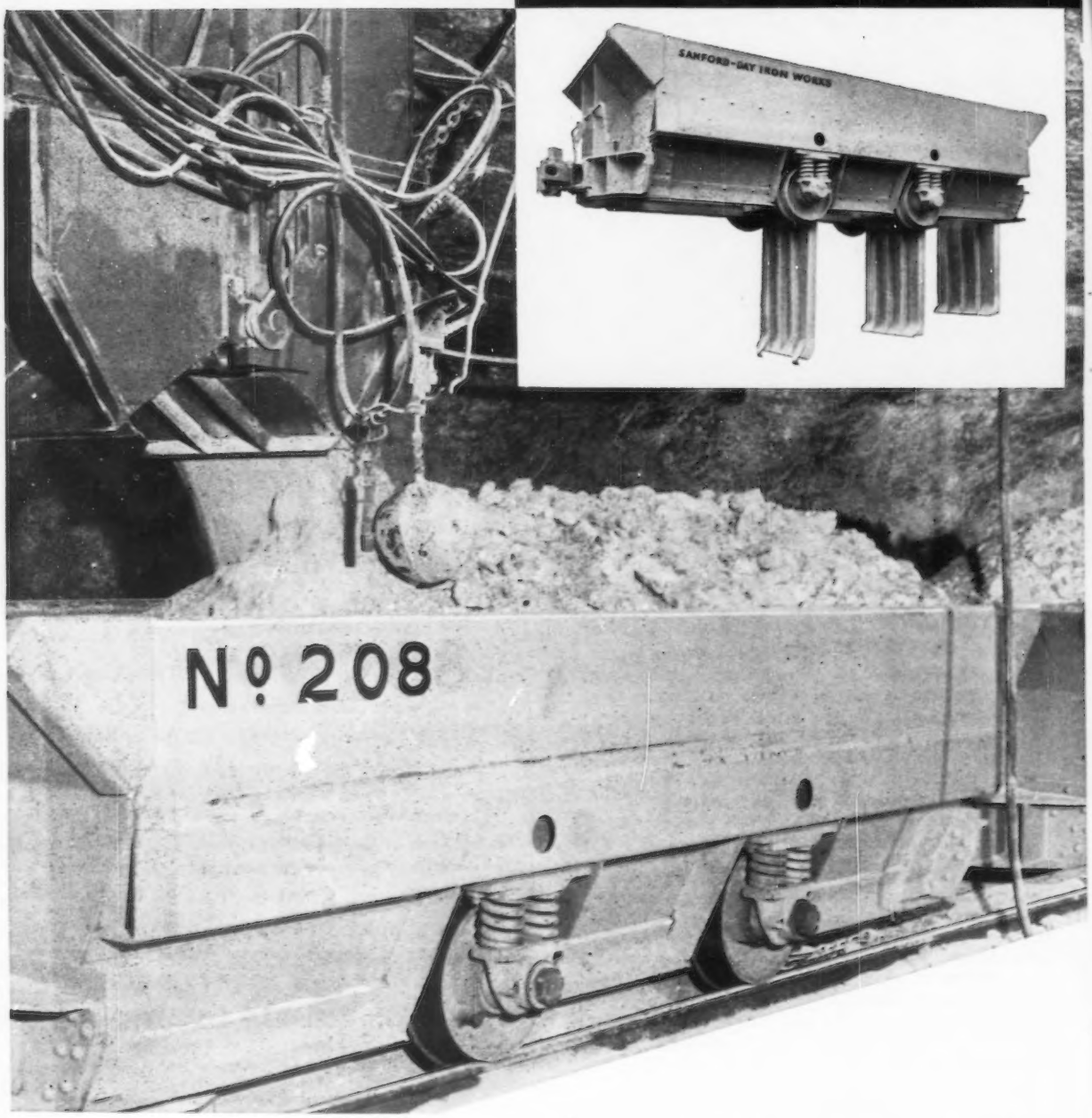
C-TL-149

industrial wheel and crawler tractors
loaders • dozers • backhoes • fork lifts • engines

These S-D AUTOMATICS

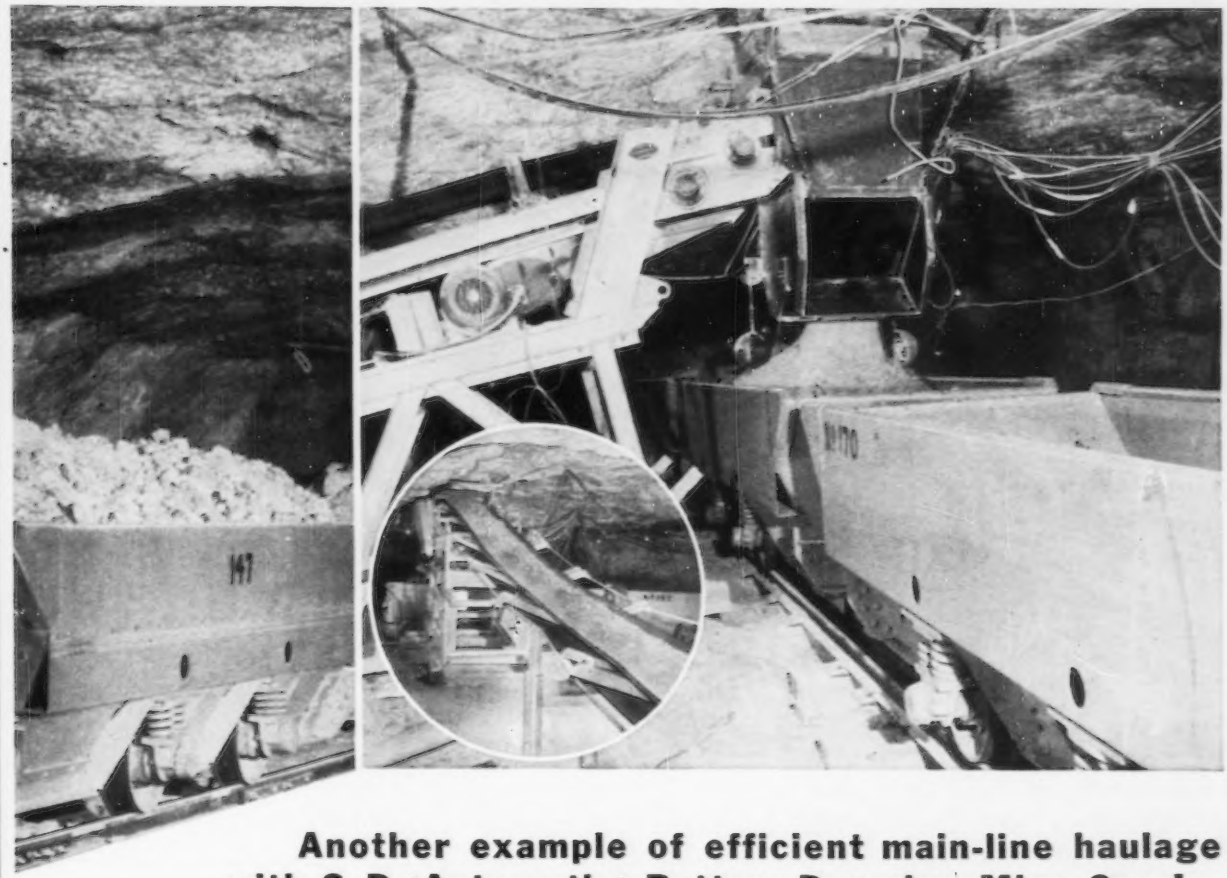


SANFORD-DAY

Knoxville, Tennessee

"SUPER MARKET FOR MINE CARS" — *all types* * PRECISION WHEELS * "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS * GISMO SELF-LOADING TRANSPORT that loads *(mucks)* in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

have been in service at U. S. Potash 3 years...working 363 days per year, two shifts per day on a seven-mile run!



Another example of efficient main-line haulage with S-D "Automatic" Bottom Dumping Mine Cars!

"Because of their low center of gravity and balanced rugged construction, they hold the track exceptionally well at speeds up to 30-miles-per-hour," reports Mr. Earl H. Miller, resident manager of the Carlsbad, N. M., mining operation of United States Potash Company, Division of United States Borax & Chemical Corporation.

"Also," Mr. Miller continues, "the door operation is very good, allowing the cars to do a good job of self-cleaning." How does the maintenance costs of these cars compare with conventional type ore cars? "We have had very low maintenance costs on the S-D 'Automatics' compared to others we are using."

Note in pictures above and on page at left that mining management at U. S. Potash have further mechanized their main-line haulage with an automatic loading station. We are understandably proud that S-D "Automatics" were chosen for this U. S. Potash operation that incorporates the latest developments in modern simplicity and efficiency. In addition to this installation, S-D "Automatics," like the car illustrated at right, are hauling hard rock in several western mines at tremendous savings! Write us today for complete information. *Sanford-Day Iron Works, Inc., Knoxville, Tennessee*

1/4 to 1/2 TON MORE CAPACITY
Twin Latches FOR SAFE AND SURE LATCHING
SANFORD-DAY IRON WORKS
Safety Sealed AGAINST DUST LEAKAGE

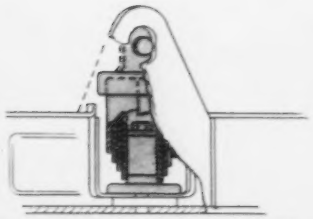
Tough hauling problem? Take a look at

If heavy loads, rough roads and steep grades, *with little or no turn-space,* are part of your hauling problems, then you'll find some answers in Koehring Dumptor. Come along on a typical load-haul-and-dump cycle:

There's no slow jockeying back and forth at the loader. Dumptor spots into position fast — is loaded over the sides, or over either end. Wide-flared 6-yard body, with low height, provides a big square target — *64 square feet, to be exact.* This reduces spillage, steps up output of shovel, dragline, clamshell, or tractor type loader — adds extra trips to daily production.

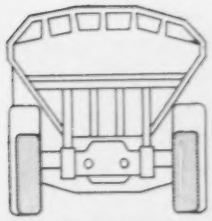
On the haul, Dumptor accelerates fast, pulls through soft ground with less shifting — climbs 24% ramps or grades fully loaded. It has better than 6 H.P. of *"go"* for every ton of loaded weight. Narrow haul roads, ledges, tunnels, overhead ramps and trestles are no problem, *There is no need to turn,* because Dumptor operates with equal ease and speed in either direction. It gets this unique *no-turn shuttle-haul* advantage through a constant-mesh transmission that gives the same, fast, 3-speed travel forward and backward. Every turn saved cuts 15 seconds off cycle-time.

At the dump area (above), *gravity* tilts the body, dumps the load in *one second.* No 15 to 25-second wait for slow-acting mechanical body-hoist — no hoist maintenance. *Gravity-dump* never balks — never wears out. Heavy-duty Dumptor



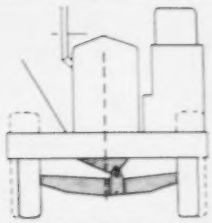
HEAVY-DUTY CHASSIS SPRING

Dumptor has just one chassis spring — a heavy snubber-type, mounted between main frame and steering axle. No leaf springs. Big shock-absorbing drive tires eliminate springs and spring maintenance on drive axle.



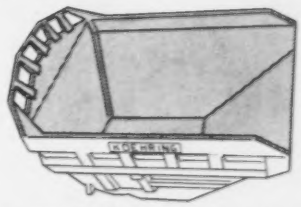
TIRES TRACK IN DIRECT LINE

Wide, heavy steering axle puts Dumptor steer wheels in line with drive wheels. Tires track in the same path. There's less rolling resistance, better traction in soft ground, on loose stockpiles and over rough haul roads.



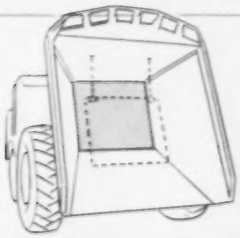
OFF-SET PIVOT ON AXLE

Pivot point on steering axle is offset from center line 3¼" toward operator side of Dumptor. There's no sag, even with unbalanced loads. Steering axle oscillates up to 21°, helps keep twisting strains out of main frame.



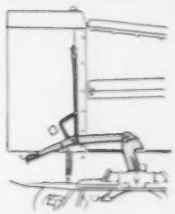
STREAMLINED ALL-STEEL BODY

There are no bulges or ledges inside the body. Top edge is box beam construction. Sides and ends are ribbed with 5 and 8-inch channels. Bottom is lined with multiple steel beams. Sturdy ridge bar joins rock guard teeth.



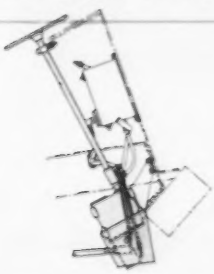
BOLTED OR FREE-SWINGING PAN

Heavy steel kick-out pan is ½" thick. Pan can be bolted to body floor for extra protection when loading rock. Remove bolts, and pan has swinging kick-out action . . . breaks load suction when dumping wet or sticky materials.



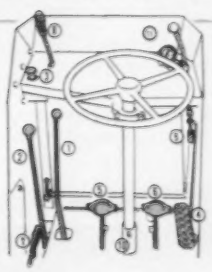
SIMPLE BODY LATCH

Body latch for 1-second gravity dump is simple and trouble-free. Latch is engaged by a single hook mounted on the chassis frame. Dump lever is located inside cab in an easy-to-reach position for quick effortless dumping.



HYDRAULIC POWER-STEER

Power steering adds to Dumptor maneuverability for fast spotting, lets driver handle off-road travel with ease. Dumptor has a short turning radius of only 19'-3", far less than other haulers of comparable capacity.



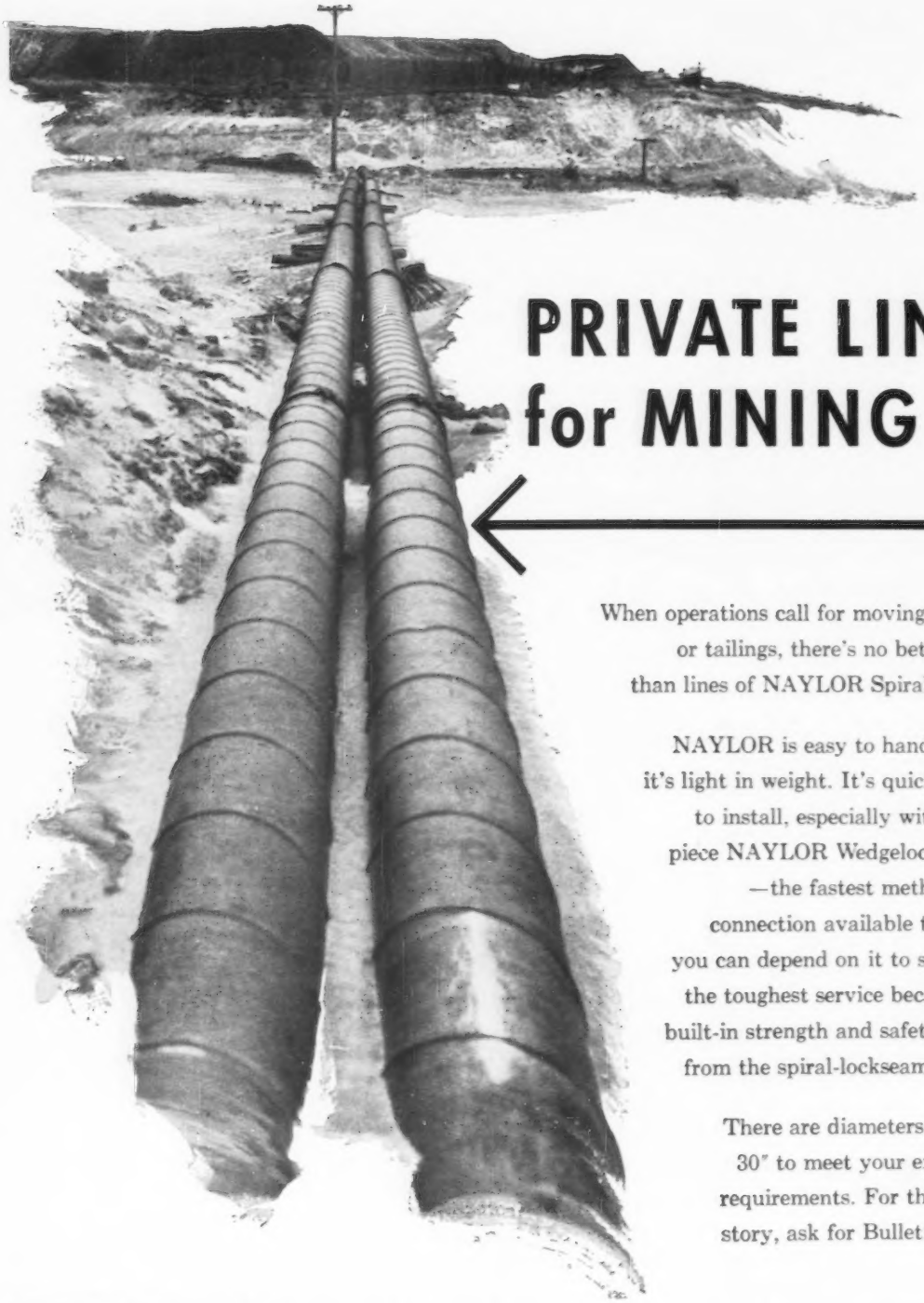
EASY-REACH CONTROLS:

(1) speed gear shift, (2) directional gear shift, (3) starting aid, (4) foot throttle, (5) clutch pedal, (6) brake pedal, (7) parking brake, (8) body release lever, (9) hand throttle, (10) light control switch, (11) Controlator.

Dumptor®....

also has a ton of strength for every ton of payload capacity. Sides, ends of body are rib-reinforced. Double-plate bottom is lined with multiple steel beams. Check its other advantages at right — then ask Koehring distributor to demonstrate what Dumptor can do on your heavy, off-road hauling. Call him *today*.

KOEHRING
DIVISION OF KOEHRING COMPANY
MILWAUKEE 16, WISCONSIN K766



PRIVATE LINES for MINING

When operations call for moving water, air or tailings, there's no better system than lines of NAYLOR Spiralweld pipe.

NAYLOR is easy to handle because it's light in weight. It's quick and easy to install, especially with the one-piece NAYLOR Wedgelock coupling —the fastest method of pipe connection available today. And you can depend on it to stand up in the toughest service because of the built-in strength and safety resulting from the spiral-lockseam structure.

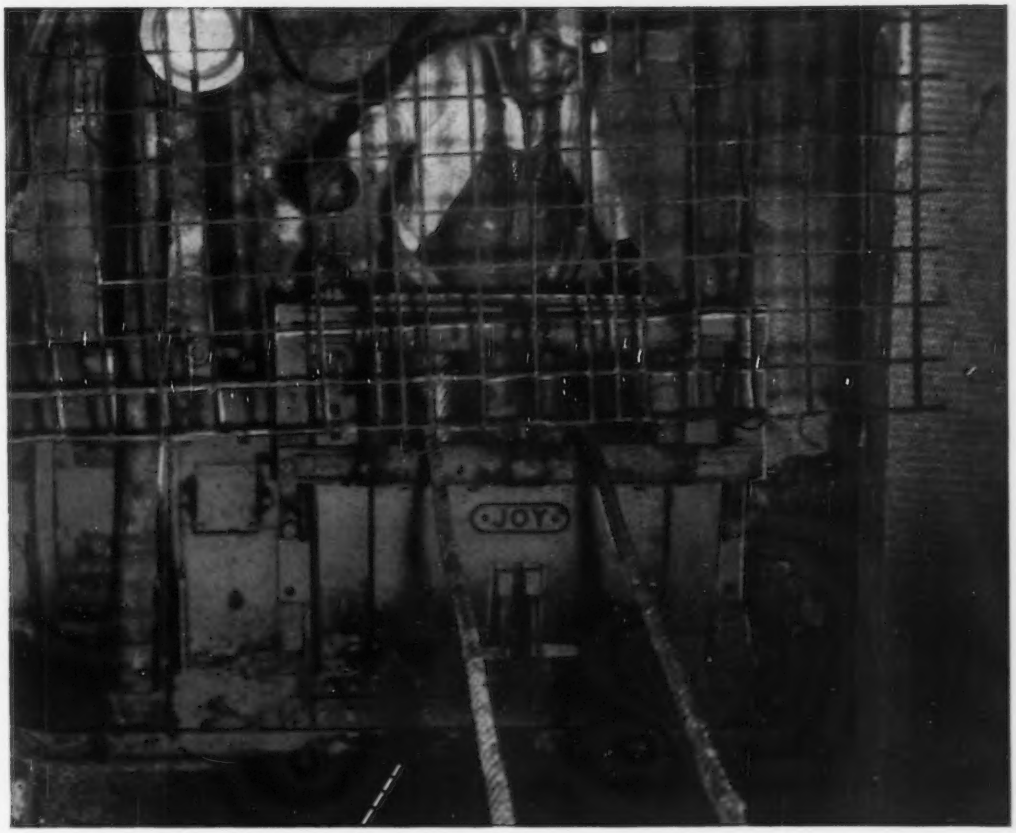
There are diameters from 4″ to 30″ to meet your exact piping requirements. For the complete story, ask for Bulletin No. 507.

NAYLOR

NAYLOR PIPE COMPANY

1243 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office • 60 East 42nd Street, New York 17, N. Y.



MEDIUM IN SIZE . . . LARGE IN CAPACITY
A NEW CONTINUOUS-RATED SLUSHER FROM JOY

The C2F-211A is a *new* kind of slusher. It is the size of a medium capacity machine . . . compact and portable enough to move from place to place in the mine. Yet, it approaches large capacity slushers in load lugging ability and hour-after-hour stamina.

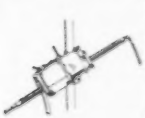
To meet extra-heavy digging requirements this newest Joy slusher is powered by a 50, 60, or 75 HP high-torque, high slip, flange-mounted motor. The high torque developed pulls the scraper through the pile without stalling. By eliminating repeated stalling and starting, fewer shock loads are imposed on the machine. Other features, such as *three* idler gears in each drum's planetary system provide 50% greater capacity.

Depending on motor horsepower and rope pull desired, rope speeds range from 165 to 350 feet per minute. Find out more about the C2F-211A, the new medium-sized slusher that hauls the bigger scraper loads. Write **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW M 6703-183

WRITE FOR FREE BULLETIN 183-4

JOY . . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY


Core Drills

Slushers

Rock Bits

Trackless Equipment

This Bucyrus-Erie 150-B shovel is working near Virginia, Minn.

In the Pit—Where Production Increases Begin
Bucyrus-Erie Electric Shovels Set the Pace

Everywhere on the Range, you will find Bucyrus-Erie electric shovels helping meet today's needs for increased output. Their advanced design assures not only high daily production but the month-after-month dependability that sustained big output requires.

The modern front end, with exclusive two-section boom, tubular dipper stick and twin dual hoist provides great strength for tough digging, along with reduced weight for loading more payload. Main machinery is powerful, capable of speedy work cycles. Ward Leonard variable-voltage control permits rapid acceleration and deceleration, assures extra torque when it is needed. Heavy-duty construction throughout means low maintenance, long life.

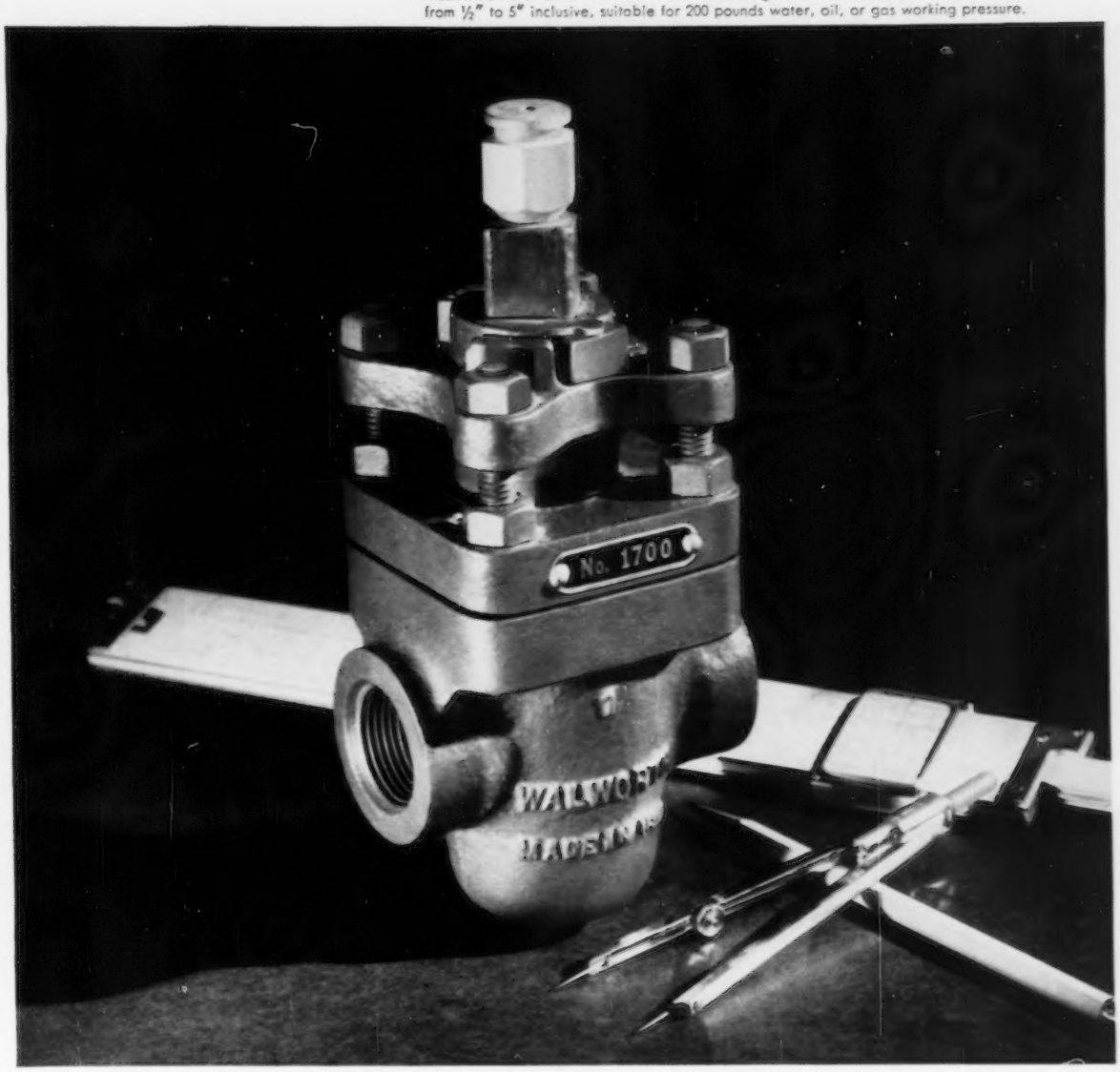
Let us tell you more about how Bucyrus-Erie electric excavators can help you reach higher production goals—economically. Bucyrus-Erie Company, South Milwaukee, Wis.

156L57C

BUCYRUS ERIE

A Familiar Sign at Scenes of Progress

Illustrated here is the Walworth Lubricated Plug Valve No. 1700, available in sizes from ½" to 5" inclusive, suitable for 200 pounds water, oil, or gas working pressure.



problem-solvers for tough jobs

*LPV's by WALWORTH

If you're familiar with the basic advantages of Plug Valves, you know why Walworth Lubricated Plug Valves work so well in really tough spots. You know about their direct port opening . . . their dead tight shut off. Seating and sealing surfaces are fully protected from attack by fluids being handled by insoluble lubricants.

*Lubricated Plug Valves

Remember, you can get Walworth LPV's in all sizes . . . from ½ to 30 inches . . . for pressures up to 5000 psi and for vacuum service . . . in a number of different styles and patterns. For more information about LPV's and for your copy of the new Walworth LPV Circular, see your local Walworth Distributor.

WALWORTH

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. SOUTHWEST FABRICATING & WELDING CO., INC. • M&H VALVE & FITTINGS CO. • WALWORTH COMPANY OF CANADA, LTD.

It's 1968 at Cyanamid's Stamford Laboratories!

The metallurgical chemicals you will use ten years hence are being researched right now at Cyanamid!

Our Field Engineers keep us constantly supplied with first-hand intelligence of mining and mill conditions the world over. Mature evaluation of these reports in the light of 40 years' experience enables us to anticipate your needs long before they arise.

Thus there is lead time for thoughtful problem evaluation, wisely-channeled research effort, plus laboratory and pilot-scale studies to develop the most economic application of new products in the mill.

This ten-years-ahead research and the services of Cyanamid Field Engineers are among the extra values freely offered to both present and prospective users of Cyanamid Reagents. We will be glad to serve you.

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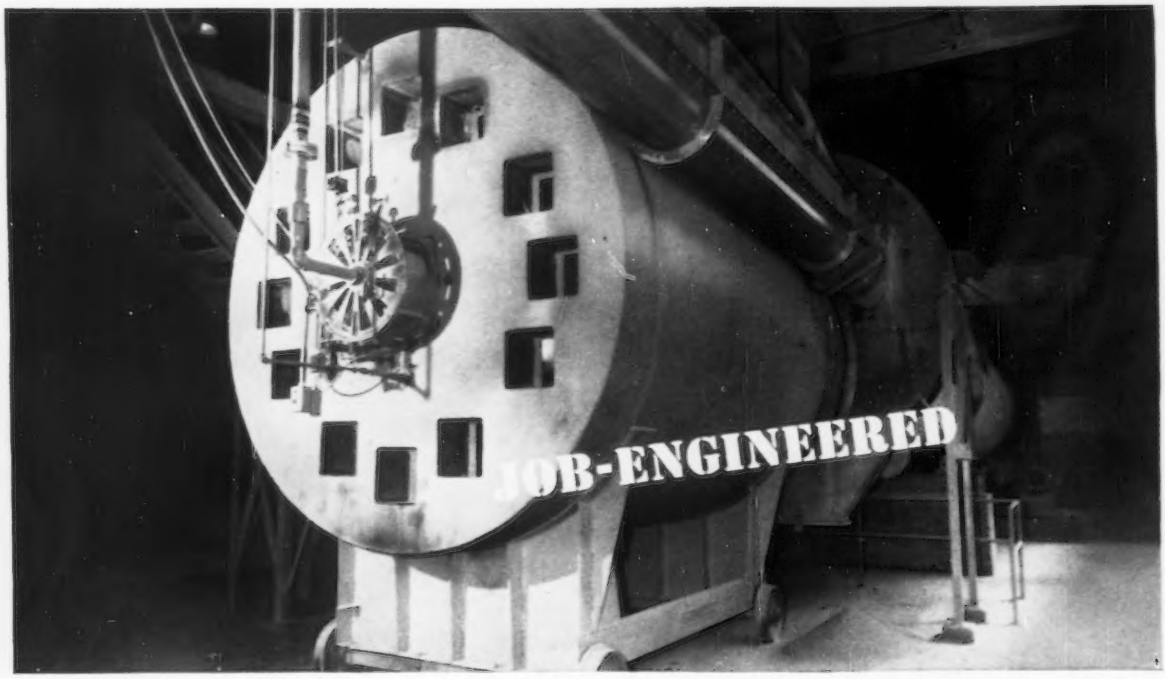
AMERICAN CYANAMID COMPANY
MINING CHEMICALS DEPARTMENT
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Helping others produce a better product...

STANDARD HERSEY DRYERS



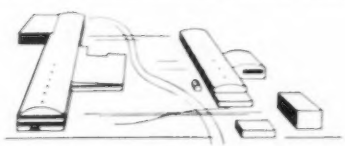
MINING FOR FOOD TO FEED THE EARTH— NEW CARLSBAD PLANT OF NATIONAL POTASH IS ON STREAM WITH STANDARD-HERSEY DRYERS!

Deep into the earth—1300 feet, deepest in the nation's potash industry—National Potash near Carlsbad, N. M., is mining for food to feed the earth, so that the earth will feed man better! Designed refinery capacity is 400,000 tons per year. And at the heart of this operation are 60-foot-long twin rotary dryers—*job engineered* Standard-Hersey dryers—designed and built by Standard Steel Corporation . . . a world leader in designing and manufacturing dryers, granulators, and coolers. Wide range and flexibility in Standard-Hersey dryers help you to produce almost any desired grade of fertilizer.

No matter how tough the problem, Standard Steel's *job engineering* solves it.

IF YOU HAVE A PROCESSING PROBLEM!

Standard Steel welcomes the opportunity to discuss with you any problems you may have in drying, cooling, or calcining. Our laboratory pilot testing equipment determines beforehand the best equipment for your problem.



STANDARD STEEL ACQUIRES LEADER IRON WORKS

Since Leader 1888

To meet the ever increasing needs of its world-wide customers, Standard Steel Corporation recently purchased the Leader Iron Works at Decatur, Illinois. Founded in 1888, Leader is well known for its work in the food, chemical and petroleum industries. In addition to its customary fabrication Leader will now manufacture Standard's line of heavy processing and road construction equipment.

STANDARD STEEL CORPORATION

General Offices & Plant, 5060 Boyle Avenue, Los Angeles 58, California

Midwest Offices & Plant **LEADER IRON WORKS** *Decatur 60, Illinois*

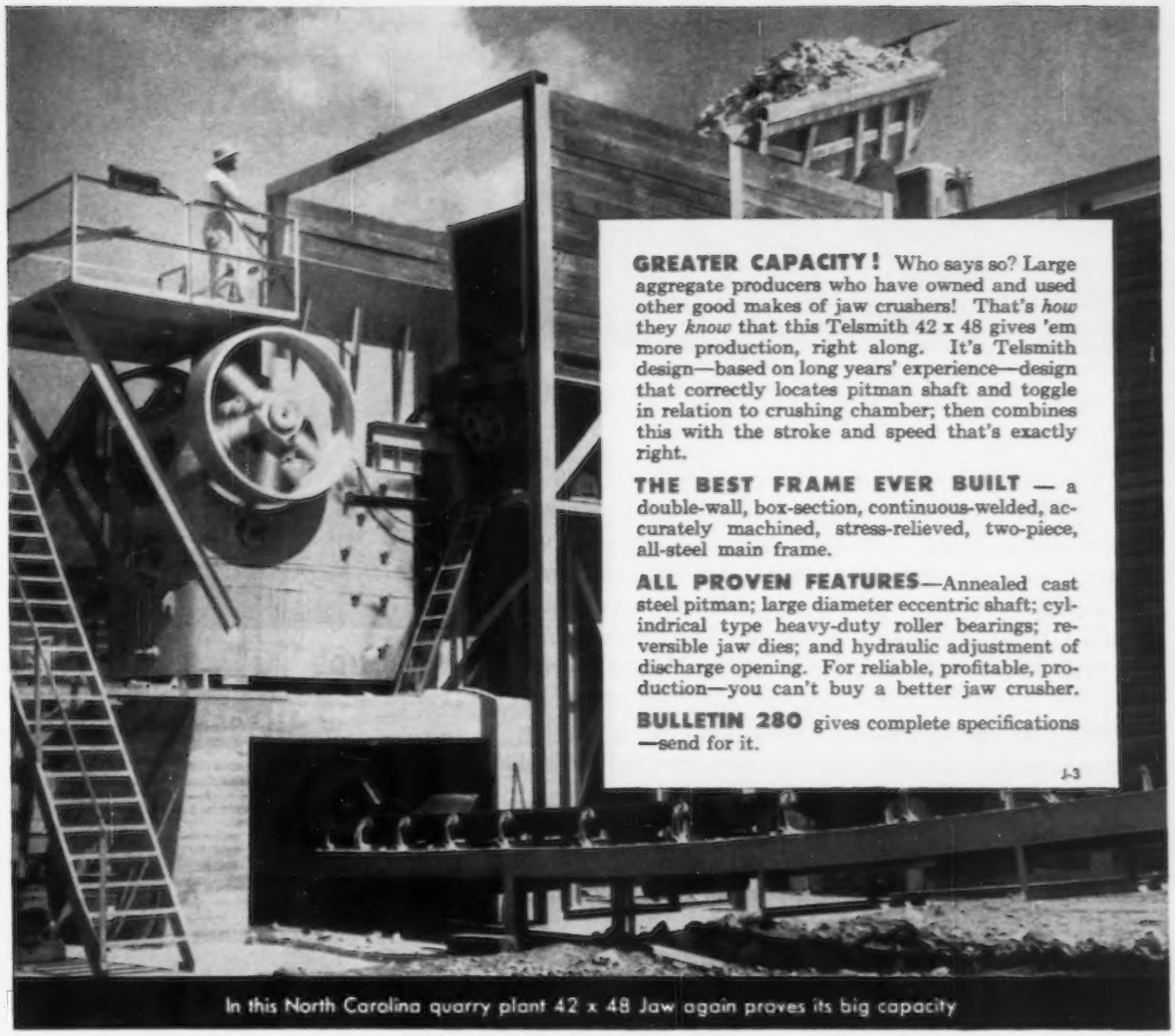
(Division of Standard Steel Corporation)

ROTARY DRYERS · KILNS · COOLERS · ASPHALT PLANTS

TELSMITH

42" x 48" JAW CRUSHER

with welded steel frame



GREATER CAPACITY! Who says so? Large aggregate producers who have owned and used other good makes of jaw crushers! That's *how* they *know* that this Telsmith 42 x 48 gives 'em more production, right along. It's Telsmith design—based on long years' experience—design that correctly locates pitman shaft and toggle in relation to crushing chamber; then combines this with the stroke and speed that's exactly right.

THE BEST FRAME EVER BUILT — a double-wall, box-section, continuous-welded, accurately machined, stress-relieved, two-piece, all-steel main frame.

ALL PROVEN FEATURES—Annealed cast steel pitman; large diameter eccentric shaft; cylindrical type heavy-duty roller bearings; reversible jaw dies; and hydraulic adjustment of discharge opening. For reliable, profitable, production—you can't buy a better jaw crusher.

BULLETIN 280 gives complete specifications —send for it.

J-3

In this North Carolina quarry plant 42 x 48 Jaw again proves its big capacity

SMITH ENGINEERING WORKS

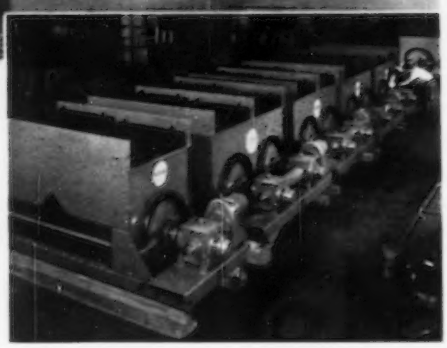
502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

Representatives in Principal Cities in All Parts of the World • Cable Address: Sengworks, Milwaukee

129 MILLION YARDS —and this YUBA DREDGE is still going strong

Yuba Dredge No. 94 digs to 112′ below water level with 18 cu. ft. buckets. Among the 175 California type placer mining dredges built by Yuba, some have digging depths to 120′.

In over half a century of dredge design and construction, Yuba has built more California type placer mining dredges than any other manufacturer. Successful operation on every continent gives daily proof of the ruggedness, advanced engineering, and practical experience built into every Yuba Dredge. Sectional pontoon hulls and unitized construction simplify disassembly for easy relocation by ship, train, plane or truck. Minimum downtime is assured by such exclusive features as the Yuba designed seal which protects underwater bearings. For the most productive dredges and parts – bucket ladder, suction or clamshell – and for specialized mining equipment – contact Yuba Mining Division today.



YUBA JIGS

Proved for profitable gravity separation at lowest maintenance. Yuba Jigs feature fully enclosed drive mechanism, side diaphragm operation, positive action over entire bed, adjustable speed and stroke, and easily changeable screens. This adds up to maximum recovery under all operating conditions. Ideal for concentrating gold, iron, cassiterite, sapphires, diamonds, and a wide range of other ores – or special sand and gravel cleaning. Investigate these compact high production Yuba Jigs for new or old dredges or plants. Let Yuba specialists know your operating problems.

YUBA MINING DIVISION

DREDGES • JIGS • TROMMELS • ROTARY FEEDERS
DREDGE PARTS • SCREEN PLATES • SLURRY PUMPS
CUSTOM ORE HANDLING EQUIPMENT

675 EAST H STREET • BENICIA, CALIFORNIA

YUBA CONSOLIDATED INDUSTRIES, INC.

The Ruberoid Co.'s 210 hp Tournatractor cleans-up quarry floor around shovel. High forward and reverse speeds, plus instant-shift, enable operator to work in and out around shovel without delaying load cycles.

Asbestos at the site of Ruberoid's Vermont mine was discovered by a woodsman in 1892 on Mt. Belvidere, one of the northernmost peaks of the Green Mountain chain. Today — employing more than 200 men — operations are being carried on from the 1,500-ft. level down to the 1,050-ft. level, across a width of about 3,000 ft. Asbestos-bearing ore is blasted loose from the quarry face and hauled to crushers. After a number of steps of crushing, ore is milled to remove valuable fiber. Asbestos fiber from the Vermont mine has a variety of uses in fireproofing materials, plastics, paper, millboard and, most important, many long-lasting, maintenance-free building materials.

Cutting costs at largest U.S. asbestos mine...

one rubber-tired tractor handles clean-up around 4 scattered shovels . . . shuttles back and forth to level overburden dump

At their 3,000-acre quarry on Mt. Belvidere, near Lowell, Vermont, The Ruberoid Co. of New York is extracting asbestos-bearing rock around the clock, winter and summer. Men and machines are literally moving huge sections of the mountain from pit to processing plant. The latest, most modern equipment and methods are employed. One rubber-tired 210 hp Tournatractor® adds to the efficiency of this operation by handling all clean-up around shovels and dump. This LeTourneau-Westinghouse tractor is on call constantly, 24 hours a day, every day of the year.

Rubber-tired tractor drives to scattered jobs fast. Tournatractor handles clean-up assignments at the Vermont mine 24 hours a day . . . year-around, through winter and summer.

Dozes at speeds to 3.3 mph

Tournatractor's primary task is cleaning-up around the mine's 4 large electrically-controlled shovels. Keeping this area of the quarry floor smooth and free of loose rock, helps lower tire maintenance costs on haulers, and permits faster shovel operation. With its dozer blade, Tournatractor pushes big rock to bench toe at speeds to 3.3 mph; return is made in high reverse, 7.2 mph.

Travels mile in minutes

In order to handle maintenance on overburden dump, Tournatractor must travel one mile from the "upper mine". It takes only a few minutes for this fast-stepping, rubber-tired tractor to drive to the dump. It goes right to work . . . completes the job and quickly returns to quarry floor. Tournatractor makes this 2-mile round-trip a number of times each day. Another assignment is to clean-up after blasts. Also, unit occasionally helps pioneer roads into new areas of operation. Wherever Tournatractor goes, its big, low-pressure tires cross electric-cables, air-drill hoses and blacktop.

High-speed operation with low maintenance

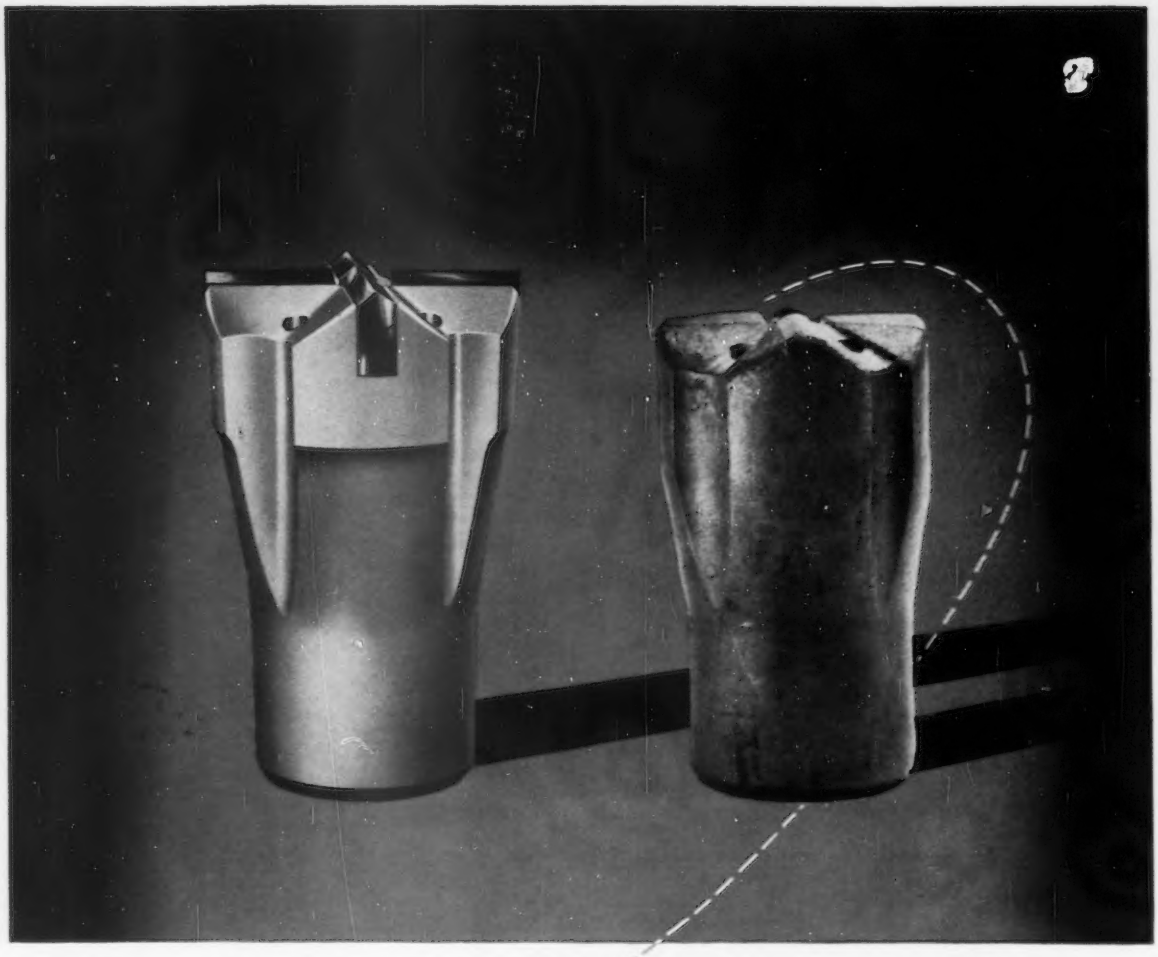
On shovel clean-up, owner-verified reports show Tournatractor out-produces conventional tractors 2-to-1. Users find that Tournatractor works and travels faster, gets more work done in less time. Owners find, also, that tires cost less to maintain . . . eliminate the need for expensive track repairs or time-consuming track assembly lubrications. Why not let us show you how Tournatractor can help *you* increase production and lower operating costs? Call or write for a demonstration.

CT-1669-MJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



THIS JOY BIT DRILLED 1000 *extra feet of hole*

YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"	2½"	1¼"
1⅝"	2¾"	1⅜"
1¾"	3"	1½"
1⅞"	3¼"	1⅝"
2"	3½"	1¾"
2⅛"	4"	
2¼"	4½"	
2⅜"	5"	
2½"	4"	
2¾"	4½"	
3"	5½"	
3½"	6"	
4"		
4½"		

NOTE: Orange shade indicates x-type.
Black shade indicates 6 point rose design.
Others are cross type.

WRITE FOR FREE BULLETIN 198-4

The real test of any tungsten carbide bit is—*how far does it drill?* The pictures above show a Joy bit before and after it drilled over 1900 feet of hole.

On a New England dam job, all other tungsten carbide bits had averaged 950 feet. Joy bits doubled this footage . . . averaged 1900 feet . . . gave the contractor a 2 to 1 advantage. (Particulars on request.)

You, too, can boost your bit footage and cut costs substantially with Joy Tungsten Carbide bits. Their offset wings, deep-slotted chipways, precision-milled threads, new brazing technique, long-lasting carbides and special alloy steel bodies make the difference. These features assure you of longer bit life and lower cost per foot of hole.

Get complete information from ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** *In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

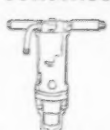
WSW M6821-198

JOY EQUIPMENT FOR MINING . . . QUARRYING . . . CONSTRUCTION

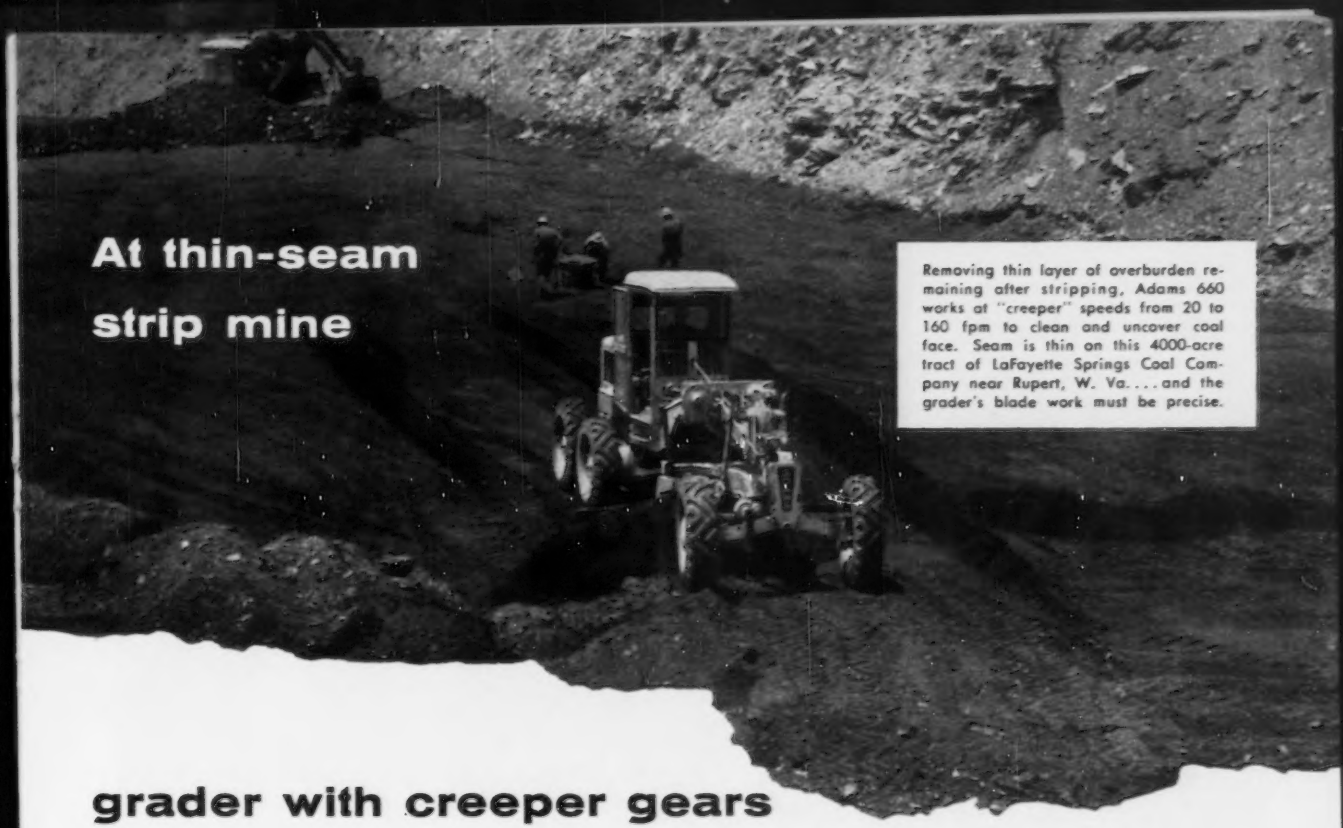
PORTABLE COMPRESSORS

WAGON DRILLS

TUNGSTEN CARBIDE ROCK BITS



HAND-HELD ROCK DRILLS



At thin-seam strip mine

Removing thin layer of overburden remaining after stripping, Adams 660 works at "creeper" speeds from 20 to 160 fpm to clean and uncover coal face. Seam is thin on this 4000-acre tract of LaFayette Springs Coal Company near Rupert, W. Va. . . . and the grader's blade work must be precise.

grader with creeper gears insures profitable coal recovery

Near Rupert, W. Va., the LaFayette Springs Coal Co. of Lewisburg is strip-mining coal from a slate-laced vein 38" thick, which lies under 50' to 75' of overburden. To work this thin seam at a profit requires the use of precision machinery in the recovery process.

LaFayette strips the bulk of the overburden with a large dragline. A thin layer of overburden is left covering the seam. This final covering is carefully bladed off by an Adams* 150 hp 660 motor grader, using powerful, low-speed creeper gears (optional equipment on Adams graders). Operating with full power in 1st gear, at speeds of only 20 to 160 feet per minute, the operator smoothly readjusts the 12' blade of the "660" to match the seam's frequent surface irregularities.

The result is a clean, efficient job of exposing the face of the coal seam. Then—after removal of scattered, vertical slate traces by hand — the clean coal is ready for loading out.

"handles our exacting work"

"I like the way the '660' is built," said Warren Ervin, superintendent. "I like the quick way it performs, its accuracy . . . and the way it handles our exacting work throughout the day."

Operator W. H. Judy agreed. "It's a fine machine," he stated. "It performs better than any I've ever run — and I've run a lot of them in 35 years. This '660's' really got power."

Completes 33% more roadwork

When not doing precision blade work on overburden, the firm's LeTourneau-Westinghouse Adams grader patrols haul roads around LaFayette's 4000-acre area. Operator Judy says the "660's" combination of 150 hp diesel power, 0.23 to 26 mph speed, and accuracy of blade control, speeds all road maintenance.

Choose from 6 work-matched models

Why not find out, in detail, how a powerful, ruggedly-built Adams grader can increase the efficiency of your mine or pit operations? There are six models available, from the 60 hp "220" to the 190 hp POWER-*Flow** 660 with torque converter. Describe your operation, and we will furnish details on the Adams that fits your needs.

Busy haul roads are smoothed regularly by Adams 660. The "660" handles 33% more road maintenance in the same time than a grader previously used.

*Trademark G-1765-MJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

BIG PROJECTS PROVE IT!

Firestones beat downtime delays!

From the Los Angeles Freeways to the Connecticut Turnpike, Firestones lead the way in beating breakdown losses. Firestone Rock Grip Tires, with S/F (safety-fortified) Nylon, roll longer with less downtime than any other tire! Two great tread designs match these off-the-highway tires to *any* job and eliminate tire changes. You get the *flotation and traction* you need in loose earth and wet going. You get S/F Nylon's armored protection for hauls over splintered shale and knife-edged rubble. Firestone tires defy cuts and slugging impacts like no other tires made. Ask your Firestone Sales Engineer about these *tubed* or *tubeless* heavy-duty tires. Call him today at your local Firestone Dealer or Store.

ROCK GRIP WIDE BASE ROCK GRIP

Firestone

BETTER RUBBER FROM START TO FINISH

Enjoy the Voice of Firestone on ABC television every Monday evening.

Copyright 1958, The Firestone Tire & Rubber Company

No. 3 in a series

Right off the Wire

A new system using multiple cathodes is said to double the life of the vapor lamps used on highways.

A thermionic converter has been made that produces electricity directly from heat with an efficiency of eight per cent.

Studies of the northern lights being made with a high-powered, long-range radar may disclose a method of defense against missiles coming over the arctic.

Submarine cable can be made in any length at the Simplex Submarine Cable Division's dockside plant. Single lengths are limited only by the capacity of a cable ship's hold, or the length of a train of gondola cars.

An electronic system of bank record keeping handles random-sized, unpunched paper checks at the rate of 1800 checks per hour to 40,000 accounts.

The world's largest solar furnace is being designed for installation in New Mexico. It will produce temperatures as high as 8,000°F.

Elimination of thermal noise by operating microwave amplifiers at the temperature of liquid helium has been found to greatly increase the range of radar.

An electronic map plotter is expected to make possible more accurate and cheaper maps from aerial photographs and to lend itself to the automation of mapping.

Plans are being made to mount telescopes on balloons in order to make observations above the interference of the earth's atmosphere.

The U. S. Air Force has patented an infrared television camera for use at night or in fog.

A new chemical plant will need no outside source of fuel after operation has begun. All the heat required will come from the process.

It has been found that one area of the human brain contains a record of every detail of the person's experience. Total recall can be produced by the stimulation of a minute electrical pulse.

Phosphors applied to textiles, sheet materials or metal mesh light up when a current is passed through them thus making draperies, for example, sources of illumination.

A new microscope for the study of living tissues uses bursts of ultraviolet light too brief (one thousandth of a second) to injure the tissue. The image appears in color on a television screen.

A new drug promises to save the lives of many persons who might otherwise die from lethal doses of radiation. It has been tried only on laboratory animals.

A form of fiber glass containing uranium 235 has been developed as a fuel for atomic furnaces.

A new amplifier is expected to extend the range of radio telescopes about ten times, enough to equal the best optical instruments.

A giant air mattress, equipped with arresting and launching gear, has been patented for use as a portable airstrip. On it planes could make belly landings without damage.

Tellurium lead cable sheath has excellent vibration, creep and age-hardening resistance, and greater flex life and tensile strength than other lead alloys, say Simplex scientists after exhaustive tests.

A new meter for oil pipelines will measure a flow of 10,000 barrels per hour (four times the capacity of present equipment) with an accuracy of one tenth of one per cent.

Simplex C-L-X (Sealex) metallic sheath is manufactured with thermoplastic covering in colors for voltage or general industrial coding.

A device called an "electronic sentry" guards against fire, abnormal pressure, high or low water levels, temperature changes and other hazards. It calls a designated person by telephone and gives a pre-recorded message.

"Tree" of Knowledge

This strange looking growth tells an important story to the expert eyes of Simplex scientists. It's a Simplex photomicrograph showing "treeing" effect that results when a 15 KV polyethylene-insulated cable is broken down by 100,000 volts. This is typical of the continuing research work done at Simplex.

If you are interested in the important facts that Simplex scientists Kitchin and Pratt have discovered on polyethylene treeing, write for their AIEE Paper No. 58-121.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting · Construction
Transportation · Communications
Signalling

"The American manufacturers of transoceanic telephone cables"

"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."

G. F. Franz
President

Grinding Mill Bulletin #2

This ad is directed to those grinding mill operators who are interested in increasing the efficiency and production capacity of their ball mills. It is presented by CF&I—in line with our policy "*not merely to sell; but to serve*"—in the hopes that it will add some new information on grinding procedures.

First Things First—Determine Best One Size Ball Makeup Charge

In the first article of this series, it was shown that determining the optimum size assortment of grinding balls for a makeup charge is a practical means of improving mill operation. Before an attempt is made, however, to work out a ration makeup charge, the best makeup charge of one size ball should be established.

Factors Determining Correct Ball Size Choice

Ball . . . 1) Specific Gravity (affected by voids in the ball); . . . 2) Shape; . . . 3) Homogeneity; . . . 4) Relative Cost of balls by diameter

Mill . . . 1) Inside Diameter; . . . 2) Speed (peripheral speed rather than percent of critical speed)

Manner of Operation (assuming one-stage grinding only) . . . 1) Open or Closed Circuit (percent circulating load of closed circuit); . . . 2) Mill Pulp Density (specific gravity of pulp constituents)

Feed Material . . . 1) Size Structure of Mill Feed; . . . 2) Desired Particle Reduction; . . . 3) Character of Ore, i.e. (a) Specific gravity of gangue and of mineral or minerals, and (b) Grindability characteristics (comminution to crystal sizes; comminution through crystal sizes; sliming characteristics)

Ball Makeup Charge of One Size, for a New Mill

Use all the tools at hand to determine the best one size ball makeup charge: laboratory tests of feed material, mathematical formulae, and recommendations from ball mill and grinding ball manufacturers. One's own experience, of course, is invaluable. Full confidence cannot be placed in mathematical formulae for they may not accurately take into account all the factors affecting the not-fully-understood, complex mechanics of ball mill grinding. Tests made with laboratory-size equipment can indicate grindability of ore, but such scale-size work has its limitations in that the ratio between mill diameter, mill peripheral speed, ball diameter and particle size obtained in laboratory is not the ratio that exists in the full-scale operation.

Character of Ore—So IMPORTANT!

When a new mining property is being developed, the ore body is often not accessible; so that sampling will not indicate all the types of ore that will eventually be encountered. It is important that the comminution problem of the various ores to be encountered be studied in terms of the subsequent metallurgical processes, both physical and chemical. The degree to which the ores will be blended before entering the ball mill should be taken into consideration.

If no blending or poor blending is anticipated, the most difficult grinding ore should be given the most weight in determining ball size, although this size may be too large for the softer ores.

Effect of Ball Size

Either too large or too small a ball size addition will result in decreased mill throughput and increased power consumption per ton of ore ground for ball mill operations in closed circuit. Under-size balls haven't the impact to break the larger particles effectively, adversely affecting subsequent mineral liberation. Over-size grinding ball addition results in the seasoned charge of fewer balls offering less surface for attrition grinding, thus giving too coarse a grind for efficient mineral liberation. The optimum one size ball addition is a "happy medium" between these two conditions.

The penalty for the use of too small a size ball addition is generally considered greater than for using too large a size ball, so the tendency is to favor the larger size.

CF&I grinding balls are available in diameters from $\frac{3}{4}$" to 5", and are forged from special analysis steel. They are carefully inspected throughout production and immediately before shipment to make certain they have no surface pits, circumferential ridges or other surface unevenness. They are specified by many leading mill operators. Your nearest CF&I sales representative will be glad to give you complete details.

Indications of wrong size balls used in makeup charge in an operating mill will be discussed in the next article in this series on ball rationing.

For a reprint of the article on which this ad is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P. O. Box 1920, Denver, Colorado.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Rods · CF&I Grader Blades · CF&I Industrial Screens
CF&I Mine Rail and Accessories · Wickwire Rope · CF&I Rock Bolts

FORGED STEEL GRINDING BALLS
THE COLORADO FUEL AND IRON CORPORATION
5823

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Kansas City · Lincoln (Neb.) · Los Angeles · New Orleans · New York · Oakland · Oklahoma City · Philadelphia · Phoenix · Portland
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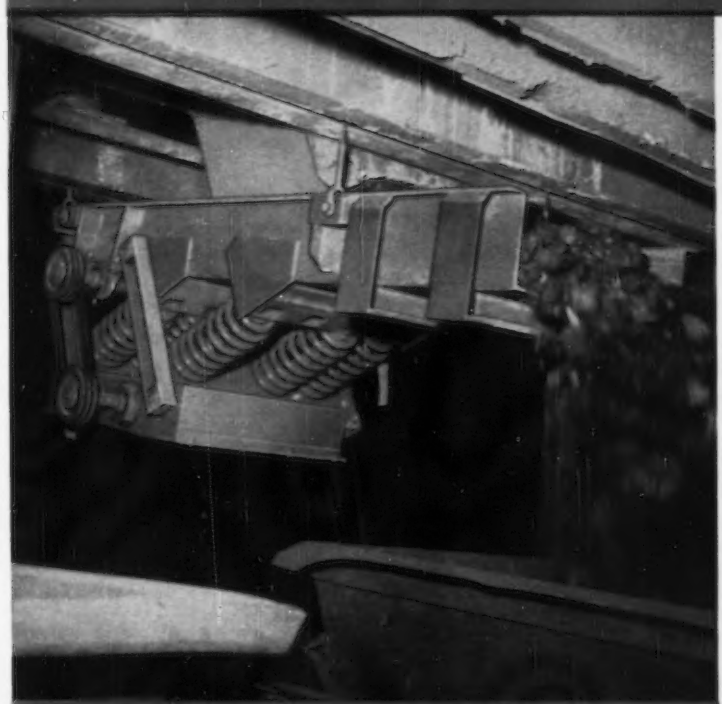
CARRIER BUILDS THEM

BIG *and* RUGGED

PATENTED 1-HP DRIVE

DELIVERS 150 TONS OF ORE PER HOUR!



- **Dependable Operation**
  Simple mechanical drive replaces complicated electrical system.
- **Low Maintenance**
  Extremely low horsepower, plus elimination by Natural Frequency of stress concentrations, assures trouble-free operation.
- **Easy Installation**
  Units can be floor-supported or suspended from above.
- **Rugged Construction**
  Troughs of ¼" to 1" steel plate, with or without wear plates.
- **Greater Lengths**
  6', 12' or longer.
- **Special Designs**
  Grizzly and screen decks available for sizing, separating and dewatering. High-temperature units up to 2000°F.

CARRIER

NATURAL-FREQUENCY

FEEDERS

Carrier Conveyor Corporation
213 North Jackson Street
Louisville 3, Kentucky

Please rush full information on Carrier Natural-Frequency Vibrating Feeders.

Company_____

Name_____

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H10AL Air Leg takes the hard work out of drilling —absorbs shock, advances the drill into the rock.

Operator can quickly and easily change position for bolting. Air Leg keeps drill in line with hole — reduces drill wear.

One Tool Handles Both Production and Rock Bolting

Le Roi H10AL Air Leg does double duty in typical stoping operation.

Recent design changes reduce wear, ease dismantling

Le Roi's H10AL Air Leg is shown here doing two jobs in a sphalerite stoping operation. Down at the 1900-foot level in a Montana mine, the operator uses both 6- and 11-foot steels while stoping. He makes an 11-foot advance per round in this horizontal breast cut and hydraulic fill stope.

After each blast, he scrapes and bolts the rock walls before drilling the next round. He doesn't need an extra tool. He merely changes the direction of his H10AL Air Leg to quickly and easily handle the rock bolting operation, too.

You can use Le Roi Air Legs as stopers, drifters, or sinkers. They have a full range of drill rotations. An exclusive 11-position feed control allows you to set and maintain any desired feed pressure from 9 psi to full line pressure. That makes it easy to keep lined-up with the hole — reduces front-end wear, eliminates rotation strain — keeps your drill-repair costs down.

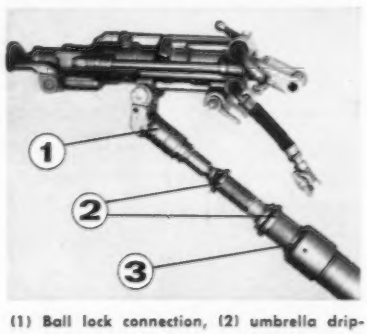
There's no third hose or clumsy "Y" connection. And the Air Leg absorbs the drill recoil. That means an easily handled rig — one that won't tire out the operator, lets him get in plenty of footage with less fatigue.

New Improvements

A sturdy ball-lock connection between drill and Air Leg on recent models permits quick dismantling for easy transportation. This unit is sealed against dirt, and is far stronger than the old bayonet-style construction.

Umbrella drip shields over both pistons keep out unwanted dirt and sludge. Bleed air at both pistons will carry oil to the cup leathers and also prevent dirt from entering the working parts at bushing and piston points. Other mechanical changes and improved metallurgy reduce wear from vibration throughout the entire feeding cycle.

You can choose from several types of Le Roi Air Legs having single or telescopic 3, 4, 5, or 6 ft. feeds. Conversion kits are available to convert older models to the new Le Roi design. Write today for complete information on this useful tool.



(1) Ball lock connection, (2) umbrella drip-shields, (3) sealed dirt-free construction.

WABCO

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Newmatic air tools, Tractair,® portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

FREE WIRE ROPE RECOMMENDATIONS TO HELP YOU SAVE MONEY

Prepared by Experts, Booklets Give Specialized Wire Rope Uses in 5 Fields

What do you do when you have to decide what rope to order? Do you rely on your memory or look up the last order?

Here's an easy way to get the right answers *fast.* Refer to the Wire Rope Recommendation Booklet prepared by HAZARD engineers as a result of years of work in the field with every kind of machine that calls for wire rope. There's a different booklet for each of five basic industries—general contracting, industrial, mining, logging and marine. We'd like you to have these booklets for quick reference because they'll save you time and money by giving you the right answer of the right rope to use for any job in your field.

Written in clear, non-technical language, these new booklets are from 8 to 24 pages long. In addition to detailed wire rope recommendations for your own field, there is a page of LAY-SET wire rope characteristics which explains fully the basic terms of diameter, construction, lay, grade and core . . . all necessary in understanding wire rope nomenclature. Many action pictures of equipment at work also help to show the reader how recommended wire ropes are actually used on the job.

Send today for copies of any or all of the 5 free Wire Rope Recommendation Booklets. Simply check the booklets you would like to receive, in the coupon provided.

HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.
Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

HAZARD WIRE ROPE DIVISION, Wilkes-Barre, Pennsylvania
Please forward the material checked below:

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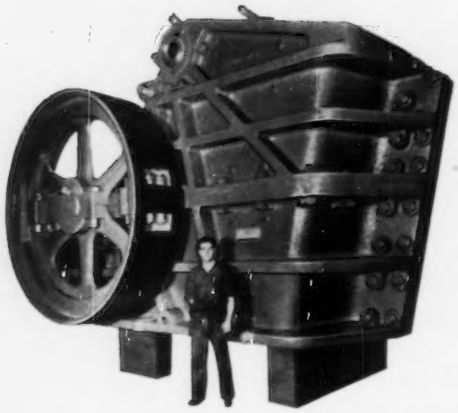
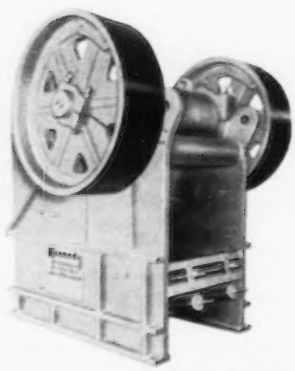
KENNEDY JAW CRUSHERS

Long life—dependable service—low maintenance—minimum power—high production—make KENNEDY Jaw Crushers the first choice of all who buy because of proven performance and low year-to-year cost.



EXCLUSIVE FEATURES OF THE KENNEDY SWING JAW CRUSHER

- Cast Meehanite or steel frame.
- Counterbalanced flywheel lifts pitman at bottom of stroke. Crusher starts without jacks or hoisting engine.
- Frame design distributes stresses evenly. There can be no failure at the corners.
- Rocking toggles require no lubrication.
- Each jaw bears exactly half the load because both are mounted at the same angle. No power is wasted in lifting the charge.
- Jaw plates are interchangeable and reversible. Shaft is integral with swing jaw.
- Wide range of sizes from 7" x 10" to 66" x 84".



FEATURES OF THE KENNEDY OVERHEAD ECCENTRIC JAW CRUSHER

- Massive, one-piece, arc welded steel plate frame.
- Close bearing position minimizes shaft deflection and lengthens bearing life.
- Heavy duty roller bearings are center lubricated under pressure.
- Extra heavy, alloy steel pitman.
- Adjustable toggles are cast Meehanite—contact seats are manganese alloy.
- Extra long, manganese jaw plates are reversible—held in place by exclusive, positive action wedge-locks.
- Crushing action and load evenly distributed over full area of both jaws. Discharge is adjustable.
- Wide range of sizes from 10" x 36" to 36" x 42".

Send for complete information on KENNEDY Crushers.

KENNEDY•VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

TWO PARK AVENUE, NEW YORK 16, N. Y. • FACTORY, DANVILLE, PA.

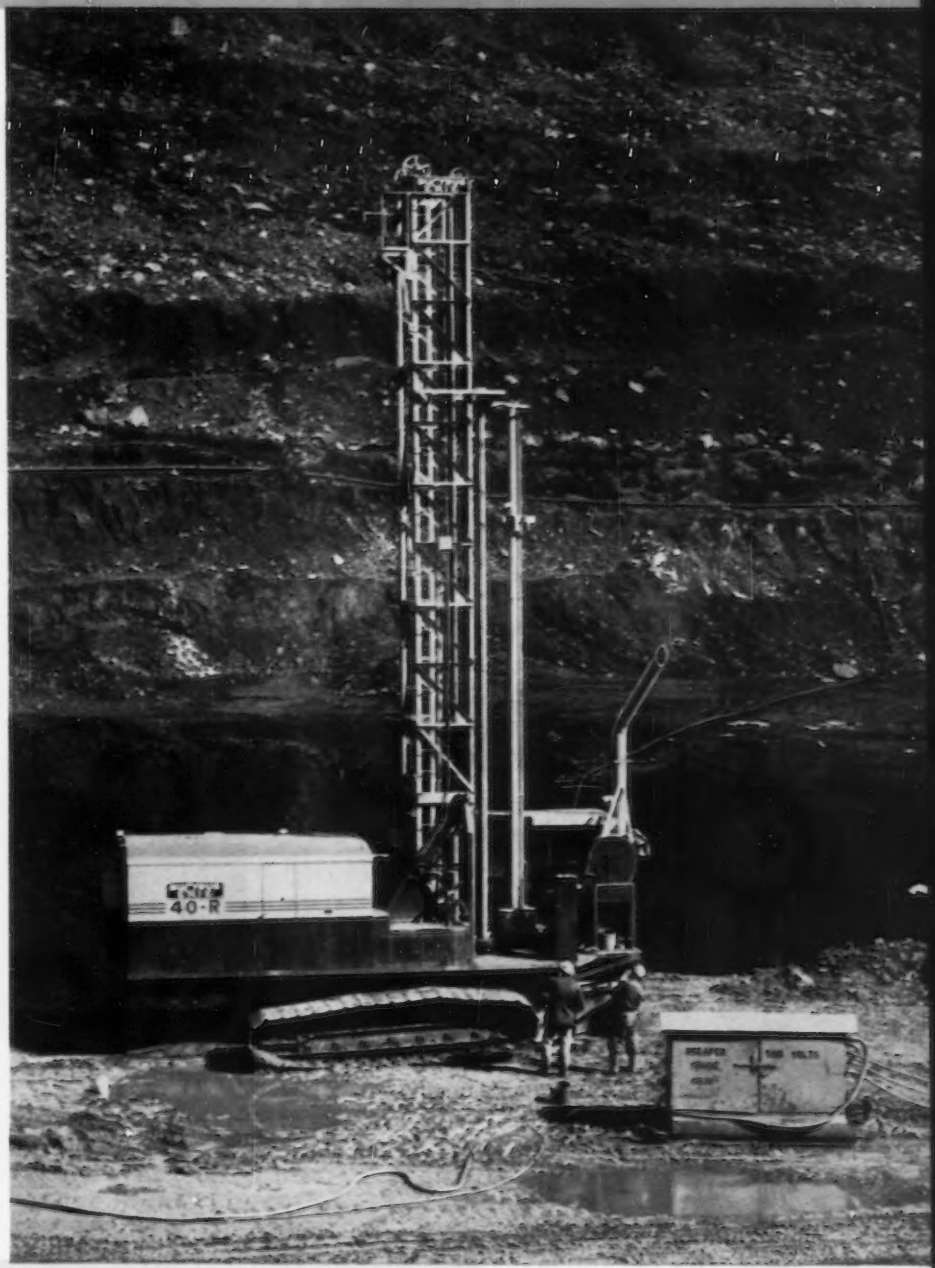
Primary & Secondary Gyratory Crushers—Jaw Crushers—Roll Crushers—Impact Breakers—Hammer Mills
KENNEDY Research and Testing Services.

Mine Operators Step Up Drilling Footage With 40-R Blast Hole Drills...So Can You!

In every open pit mine they've worked, Bucyrus-Erie rotary blast hole drills have increased drilling footage. Applied to some taconites and a variety of other extremely hard formations, they soon step up the rate of penetration so greatly that owners want to switch over completely to them.

Using compressed air to cool the bit and to clean the hole of cuttings, 40-R drills offer several advantages. By removing the need for water — a problem during cold weather — they eliminate auxiliary equipment, cut maintenance and labor costs. Heavy cuttings pile up next to the hole, providing handy, excellent stemming material. Dry sampling of the hole can be accomplished easily and more accurately.

These and other features provide the fine performance that promises even greater economies in the future. The 40-R drills 6¾ to 9-in. holes. Get all the facts on it today. 68B57C

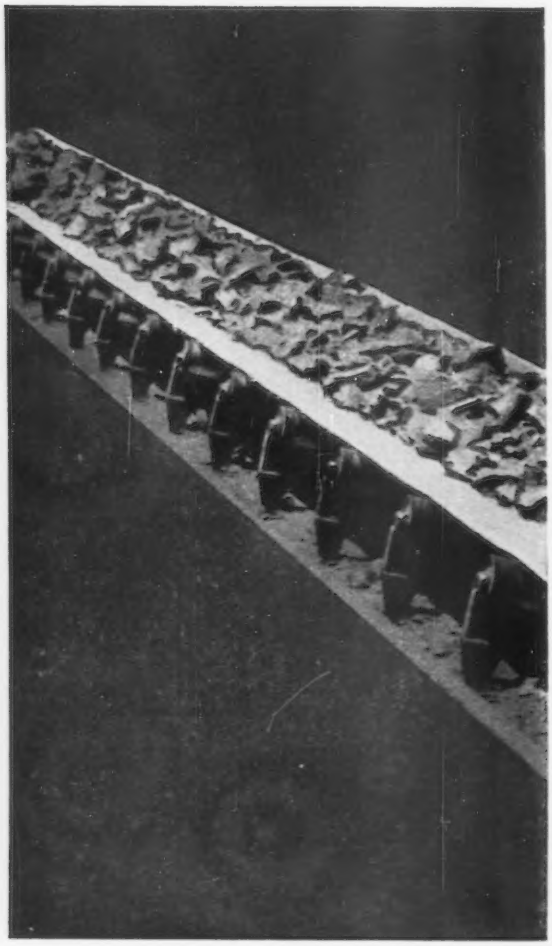


IRON ORE yields as this 40-R takes over blast hole drilling at an iron mine in south-central Canada. At this open pit operation, the machine shown here drilled 7⅞-in. holes to the same average depth drilled previously by cable tool rigs.

BUCYRUS ERIE

A Familiar Sign at Scenes of Progress

BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN



WHY BUY

ONLY 2/3 OF A BELT?

...it's the Last Third of an R/M Conveyor Belt that Gives

"More Use ~~per~~ *for your* Dollar"

It's the *last* one-third of conveyor belt life that determines its final cost. Real conveyor belt cost is the cost per foot of belt in terms of load carrying capacity for the *potential service life of the belt.* R/M's new conveyor belt construction now assures you ½ longer belt life! Here's why:

R/M engineers recognize that every belt feature—troughability, resiliency, fastener holding ability, strength member fabric, cover toughness and thickness—help determine the true cost of Ray-Man Conveyor Belt on your job. And that's why every Ray-Man component is precision proportioned to assure better belt balance where it pays off most for you—in longer belt service life!

Let an R/M representative show you how *extra* life in the last ½ of conveyor belt service means "More Use per Dollar" with Ray-Man Conveyor Belt and other R/M heavy duty constructions.

RAY-MAN CONVEYOR BELT

- Trains Naturally
- Resists Impact and Ripping
- Double Compensation Relieves Outer-Ply Stress
- Holds Fasteners
- Requires No Breaker Ply
- Exclusive "XDC" Long-Wear Cover
- Moisture Resistant, Mildew-Proof

RM812

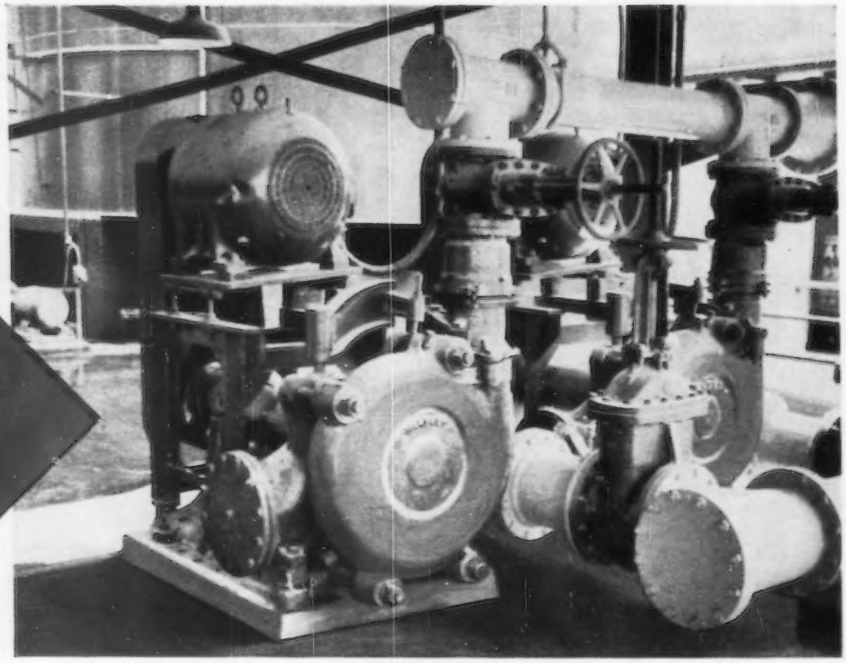
BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Here's Where You **REDUCE** Operating **COSTS!**



The moment you install **WILFLEY Sand Pumps** operating costs start dropping—production efficiency goes up. The dependable, dollar-saving performance of Wilfley Sand Pumps is well known to plant operators the world over. They know they can rely on Wilfley to give them:

Maintained *high efficiency* throughout the life of long-wearing parts.

Continuous, *trouble-free operation* without attention.

***Low maintenance costs* through simplified design and quick-change features.**

INDIVIDUAL ENGINEERING ON EVERY APPLICATION

Write, wire or phone for complete details.

Wilfley Sand Pumps
Companions in Economical Operation
Wilfley Acid Pumps

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SAND PUMPS

A. R. WILFLEY and SONS, INC.

DENVER, COLORADO, U. S. A. P.O.BOX 2330-NEW YORK OFFICE: 122 EAST 42ND STREET, NEW YORK CITY 17

URANIUM PANEL consisting of mill operators and independent producers thrashes out the impact of recent announcement by AEC to limit future mill expansion. Big question raised was: "When will commercial markets take over?"

Western Mining Meeting Studies Uranium's Future

JESSE JOHNSON announces AEC will consider uranium sales in free markets.

DEPRESSED METAL PRICES had no appreciable effect upon attendance at the 61st National Western Mining Conference sponsored by the Colorado Mining Association and held in Denver Feb. 6, 7 and 8. Attendance was about 2,000. Uranium and atomic energy were the chief subjects of interest, and papers on these topics dominated the convention. A new proposal was made to solve the current domestic crisis in the lead-zinc industry. Papers on mineral processing, mining technology and major mineral commodities rounded out a full three-day program.

Uranium Panel

A panel of uranium miners and mill operators explored problems facing the uranium industry today. Two questions were posed to guide the discussion: (1) How to obtain markets for increasing amounts of ore and concentrates, and (2) What to do about the post-1962 period?

A. P. Kibbe, president of Lisbon Uranium Co., said that the industry needed incentives and proposed expansion of the DMEA program to establish faith in a domestic uranium mining program.

Curtailment of exploration would have a net effect of driving the price of concentrates higher, said A. M. Mastrovich, general manager, Climax Uranium Co. He showed that incentives had increased ore reserves from about 1-million tons running about 0.2% U_3O_8 in 1948 to about 75-million tons of 0.25% ore. Higher grades cut down the cost of processing ores. He concluded that confidence must be restored in a uranium program, or the industry will face the danger of depletion of reserves.

"Far too much money has been wasted on wild-cat drilling and random bulldozing," reported J. B. Spaulding of the Roma Uranium Mining Co. He recommended that the average independent producer should base exploration on sound geological evidence, and after establishing ore reserves, "get his house in order and stand on his own two feet." He said any producer of commercial grade ore will be able to find a mill to process it.

Disagreement with this viewpoint came from Dr. Arthur Flint, vice president, Radium King Mines, Inc., who said that a monopoly has been created in the uranium milling industry, and that monopolies need regulation. He suggested that a greater amount of the milling capacity should be used for custom ore, and that the Government should give the small producer some kind of price protection, particularly after 1962.

Speaking also for the independent producers, Elliott Goldstein, of Uranium Enterprises, said that the lack of mill capacity was the chief problem. He said that many companies which previously had markets for their ore are being forced from the industry. He recommended: (1) Pro-rata production as in the oil industry, (2) Dividing intake of mills to assure custom producers an equitable share and (3) Paying for ore on the basis of extractable U_3O_8.

In answer to some of the foregoing producer's complaints, Wendel W. Fertig, Western Nuclear Corp., explained that his company is under contract to allocate 25% of mill capacity to custom ore, and that it must take any producer's ore provided it is amenable. Any shipper has the full right, he said, to approach the AEC and lodge a complaint if his ore is not taken. He expressed belief that the guaranteed haulage allowance would not be continued after the present expiration date, and that it would therefore be wise to stress production of ores which have to be hauled from greater distances. He said that his company is not high-

BOB PALMER keynotes convention with plea for industry unity in crises.

URANIUM SESSIONS dominated the convention. D. W. Viles (left) chairmanned outstanding session on uranium geology given by Dr. Paul F. Kerr of Columbia.

grading its deposits now, but will do so in the more competitive years to come. He advised the custom shippers to follow the same policy.

W. B. Hall, president of Vitro Uranium Co., said that his company's contract required the purchase of 40% of the intake from independent producers. However, he explained, this was based upon an intake of 240,000 tons ore per year and also a fixed number of pounds of U_3O_8. If the grade increased, as it has, the tonnage of ore purchased must drop proportionately. Any move by the AEC permitting the intake of more "pounds of uranium" would relieve the situation, he said.

Speaking in summary, Richard Young, executive vice president, Uranium Reduction Co., said, "We have suddenly jumped from what we thought was an unlimited market into a limited market." He said the AEC was aiming to provide a market for presently known reserves until 1966. "The problem now," he said, "is that everyone wants to be first in exhausting reserves, and they can't all be first." He estimated that it would be 10 to 15 years before the country would need commercial reactors, and that therefore the domestic industry should concentrate on capturing the foreign reactor market which is developing fast because of the high cost of power in Europe, Asia and elsewhere.

Gordon Weller, Uranium Institute, proposed an immediate reform in the AEC's policy of secrecy in the name of security. He suggested formation of a Government-industry evaluation committee aimed at releasing all facts regarding "this nation's contracts and commitments for the purchase of uranium from foreign sources." To further guide the uranium industry toward sound policies, he asked that "details concerning the guarantees in the uranium market extension beyond March 31, 1962, be defined in the Federal Register."

John R. Matthews, Hecla Mining Co., said that it was quite evident from statements released by the AEC that the ultimate goal of the Commission is to place the industry eventually into the hands of domestic private enterprise. Chief concern of the AEC and private capital, he said, is *when* the transition to a free competitive market should take place, rather than whether it should occur at all. Referring to an AEC announcement in 1956 of a policy to provide gradual transition from a government-controlled uranium market to a free commercial market, Matthews said the industry needs more assurance. "Recent actions taken to restrict production and public utterances have undermined the miner's confidence in the immediate future. We need to know where we stand. We need a definite confirmation of some Government support at least through 1966 in order to make plans for continuing exploration for uranium."

Panel discussion resulted in the following announcement by Jesse C. Johnson, director of the Raw Materials Division of the AEC:

"The possibilities of a commercial or free market for uranium has been the subject of a panel discussion at this conference. The Commission would welcome the views and recommendations of this panel.

"The question of a commercial market for uranium, or the approval of private sales, will be considered by the Commission in connection with its review of the current problems of the uranium industry. Our Grand Junction office is now making a survey of the industry problems and results of this survey should be ready for Commission consideration at an early date.

"Since domestic concentrate now could be produced in greater quantity than required for AEC contracts, one of the principal reasons for the Commission being the sole buyer has been removed. It is necessary, however, to establish the detailed conditions for a domestic buyer or foreign buyer to qualify for a license. The principal problem relates to the controls and safeguards with respect to export sales."

Considering the immediate dark outlook for the mining industry, Johnson said "the uranium industry is the one bright spot." He cited these statistics to establish this point: "Domestic uranium concentrate purchases by the AEC were approximately $134-million in 1956, and $171-million in 1957. Purchases for 1958 are estimated at $247-million and for 1959, at $322-million, almost double that of 1957. These estimates are based upon existing contracts and consequently the 1959 level is assured at least until March 31, 1962."

SEC Reports

New capital raised by the mining industry from public and private sources hit a peak of more than half-billion dollars in 1954. It continued well over $400-million during 1955 and 1956, and declined to an estimated $330-million during 1957, according to Edward N. Gadsby, chairman of the Securities and Exchange Commission. Number of issues for uranium out of the Denver office of the SEC has fallen from 361 in 1955, to 11 in 1957. SEC studies indicate that mining industry outlays this year will run at an annual rate of about $1.2-billion, or about 8%

LADIES EVENTS included a "Come-in-for-coffee-and-visit room," the Uranium Gold & Silver banquet and a good look at Spring fashions and hats.

TOMORROW'S MINING ENGINEERS inspect minerals at convention exhibit.

below the record outlay which took place last year.

Fusion No Threat

Controlled fusion has not yet arrived at the state where it will threaten the importance of fission, Paul F. Genachte, director of the Atomic Energy Division, Chase Manhattan Bank, told the convention. He said that even though recent experiments involved temperatures of some 5-million deg centigrade, these temperatures are far below the 100-million deg temperatures needed to achieve net gain of energy from a reaction that involves heavy hydrogen plasma.

"It may take another 10 years," he said, "before we have a self-sufficient atom industry free from major dependence on the Government, but there is no doubt that we will reach the goal of a self-sustaining atom industry. At the present time, the challenge of achieving competitive atomic power looms larger than previously anticipated. You who are in the uranium mining business, are very much in business and will continue to be more so in the years to come."

Trade Agreements Quandary

Fate of the domestic lead-zinc industry is "inescapably hinged to the problem of extension of the Trade Agreements Act," Charles Schwab, chairman of the Emergency Lead and Zinc Committee, told the convention. "It will be utterly impossible for Congressional delegates from lead-zinc producing areas to take their position on extension of the Trade Agreements Act without first knowing what is going to happen to these two commodities," he said. He mentioned two possible answers:

1. A specific amendment to the Trade Agreements Act specifying the Administration's peril points of 17c and 14½c with not less than a 4c import tax to be imposed only when unneeded and excessive imports break the United States price below these peril-point levels, or

2. A finding by the Tariff Commission for maximum increase in duties and quotas and the Executive Department approval *before* the question of extension of the Trade Agreements Act is before the Congress for a vote.

Lead-Zinc Bonus

A $50-million-a-year bonus for lead-zinc producers, to be paid out of import duties on lead and zinc was proposed by mining engineer Samuel Arentz, to stimulate the domestic industry. He said that precedent for this type of protection has been established in the wool industry which through the National Wool Act of 1954 makes incentive payments to domestic wool growers. Payments are derived from duties collected on imported wool. Incentive payments in 1956 totaled $54.7-million.

To maintain domestic mine production at a level of 385,000 tons of lead per year and 600,000 tons of zinc per year, Arentz estimated that the plan would cost about $50-million per year. This is approximately the amount of the duties that would be collected on imported metal at present tonnages and at maximum tariff rates that may be imposed by the Tariff Commission without Congressional action. Proposed bonuses would favor the small miner starting with 5c per lb of metal on production of the first 1,000 tons of metal, and declining to 1c per lb for all production over 4,000 tons per year.

Mineral Processing Progress

New mineral processing techniques involving hydrometallurgical principles were reviewed in a paper by M. F. McCarty and E. E. Woodward of the Dow Chemical Co. These were as follows:

Chemical precipitation. Although this process has been used for years to extract gold from cyanide solutions, and cement copper, the uranium industry has revived new uses for this method.

Ion exchange. Type of process in this group include the resin-in-pulp (RIP) method; stationary-bed column ion exchange plants used extensively in Canada and Africa; and the moving-bed plants in the U.S. and Canada. Two new processes that make use of ion exchange resins are the ion exclusion process and the ion retardation process.

Ion exclusion process. Separation is dependent upon the physical and chemical properties of the resin. When an aqueous soution of two or more solutes is passed through an ion-exclusion column, a separation of the solutes occurs, and they appear as separate fractions in the effluent. While the process has been used mainly to separate ionic from non-ionic solutes, it can be used also to separate two or more ionized materials when a sufficient difference in ionization exists.

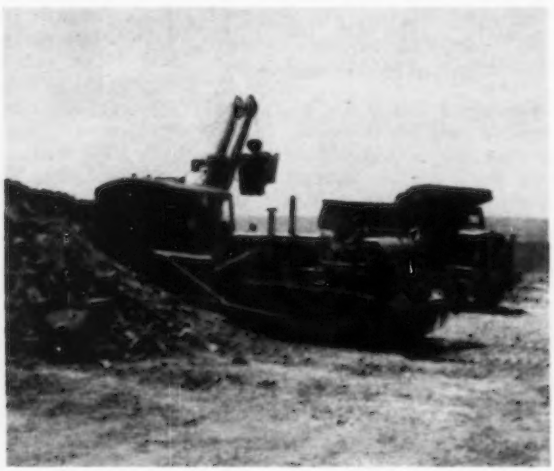
Ion retardation process. This process uses a new type of resin in which both the anionic and cationic exchange sites are located in the same bead. Thus the same resin will absorb both anions and cations from feed solutions. However, the adsorbed ions are weakly held and may be displaced from the resin by use of water as a

(*Continued on p. 208*)

MINE AND CUSTOM ORE is crushed and sampled in this dust-proofed building. Mill capacity is 440 tons per day.

LEACHING, ION-EXCHANGE UNITS and precipitation and filtering sections are housed in this wood-frame mill building.

ORE AT MIDNITE MINE occurs along crest of hill which simplifies the stripping and extraction considerably.



ENSEMBLE of bulldozer, truck and shovel is used by Isbell Construction Co. to strip overburden and mine uranium ore.

Dawn's New Uranium Mill

DON HARGROVE

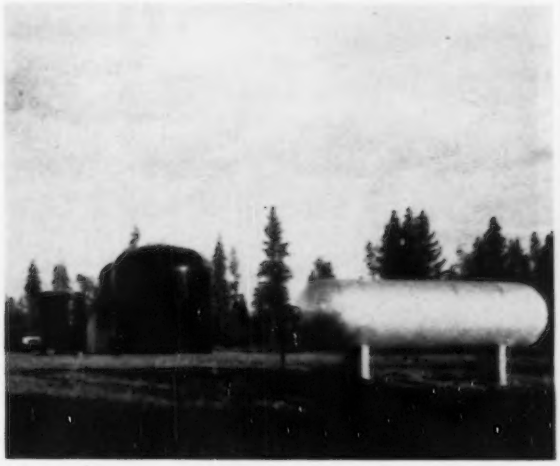
DAWN MINING CO.'s new 440-ton uranium mill which started up in August 1957 has achieved over 96% extraction. This is considerably higher than the 90 to 92% recovery indicated by test work. The plant which employs the resin-loaded column ion-exchange process is situated near Ford, Wash., about 25 miles northwest of Spokane.

Most of the ore which feeds this plant comes from the company's Midnite mine in the Spokane Indian Reservation 22 miles northwest of the mill. Here orebodies occur along a north-south trending contact between granitic and metamorphic rocks. In general the contact is exposed, or nearly so, where most of the ore has been developed. The contact dips to the east rather steeply in places, but underlies all of the known orebodies. Rocks become progressively more unaltered to the east until, a few hundred yards east of the ore zone, impure limestone outcrops. Mineralization, in general is in the schists, but it is not unusual to mine several feet of altered granite. Some of this granite contains ore above average grade.

The predominant uranium mineral

DON HARGROVE, left, author of this article, is assistant manager of Dawn Mining Co. With him is Paul Stucker, mill foreman.

Text is based upon paper presented by Mr. Hargrove at the Northwest Mining Association Meeting Dec. 7, 1957, and published with permission of the management of the Dawn Mining Co.



LARGE STORAGE TANKS indicate the substantial quantities of acids, ammonia and other reagents required by the process.

PLEASANT HOMES in a near-by pine woods are provided for key personnel. Twelve homes have been built at the townsite.

DUMP TRUCK unloads in 1,000-ton bin at the mine. From here the ore is trucked over 22-mile highway to mill at Ford.

LUBRICATION SERVICE TRUCK at pit provides greases and oils for Isbell Construction Co.'s open-pit mining equipment.

Achieves High Extraction

is autunite which occurs along the schistocity and cross fractures in the rock. This type of ore is quite different from the sandstone and conglomerate ores found on the Colorado Plateau, the Ambrosia Lake District and the Wyoming deposits. Three distinct types of ore occur at the Midnite mine: highly altered schist, altered granite and a tough blue unaltered schist. Some of the best grade ore occurs in the unaltered rock.

These orebodies fortunately do not contain minerals which cause complications in an acid-leach, ion-exchange circuit. On the contrary, the altered schist furnishes sufficient ferric iron to very definitely assist in the oxidation of the unaltered ore. A small amount of various other uranium minerals are apparent. Small amounts of custom ore have been processed. Chief minerals are autunite and urano-thorite.

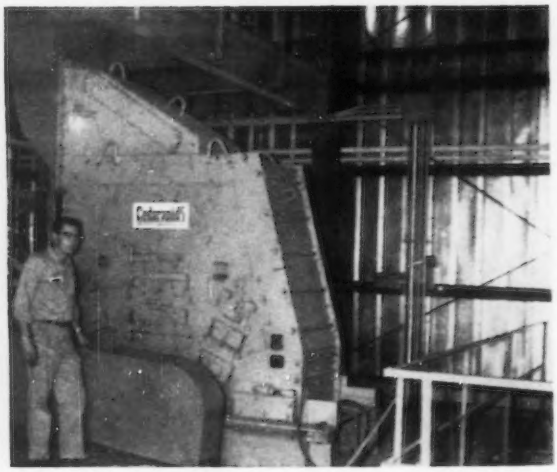
The over-all strip ratio at the open-pit deposits is approximately three to one. Mining has been contracted by Isbell Construction Co., of Reno, Nev. Actually the mine is extremely well located for an open pit operation because most of the ore occurs near the crest of a ridge. This minimizes stripping and waste disposal problems.

Ore is deposited in a 1,000-ton ore bin built near the lower orebody. From there it is loaded into 20-ton, cable-dump, semi-trailer road trucks for the trip to the mill. Ore is handled by Vic-Ore Co. on a contract basis.

Preliminary Test Work

Late in 1955 Newmont Mining Corp. officials tentatively decided that Midnite Mine ore reserves were sufficiently large and of good enough grade to warrant mill construction. A few preliminary metallurgical bench tests had been made. Extraction was good. No interfering elements were present. To obtain the necessary metallurgical data upon which mill con-

PAUL STUCKER takes the reader through the mill. Here he demonstrates the variable-speed Wobbler ore feeder.



CEDAR RAPIDS IMPACT CRUSHER has proven satisfactory on the uranium ores in the crushing and sampling plant.

struction could be based, a 500-ton sample was processed through the National Lead Co.'s pilot plant at Grand Junction, Colo. This ore was put through the resin-in-pulp circuit. Slime content was almost twice the amount usually found in RIP feed, so further tests were carried out at the Intermountain Station of the U.S. Bureau of Mines at Salt Lake City. These thickening tests proved to be satisfactory. The pregnant liquor was processed by ion-exchange and posed no problems. Further test work was conducted in a Newmont laboratory, and at the Colorado School of Mines Research Foundation.

Negotiations for a contract with the AEC were being carried out concurrently with the test program. An equipment list, flowsheet, capital cost and operating cost estimates were also being prepared. By mid-1956 design requirements had been roughed out sufficiently to allow requests for bids for plant construction to be sent out. Western Knapp Engineering Co. was selected to act as engineering and metallurgical advisors, and to construct the plant. Detailed design was started in mid-August 1956. The mill was put on stream Aug. 13, 1957. First yellow cake was produced Aug. 21, approximately 20 months after the first test work was started.

Since the project is situated in a relatively new and untried uranium area, the plant was built so that capacity could be increased if ore reserves justified such an expenditure.

Weather conditions in the area with attendant road restrictions dictated that a fairly large ore stockpile and reagent stockpile be on hand. Reagent storage capacity is sufficient for one month of operation, and, since mining is only conducted about nine months of the year, ore supplies are much greater.

The mill building is constructed of wood. Wood was chosen in lieu of steel because it was cheaper, acid resistant and more readily available.

Auxiliary buildings include: an office building, change room, power plant, laboratory, garage and crushing plant. All of these buildings are steel. All are prefabricated except the crusher building. Central heating is furnished by two Ames fully automatic boilers. All power and pipe lines between buildings are buried, leaving a clear area for traffic.

Twelve 3-bedroom houses were built for key personnel within easy walking distance of the plant.

Process handling equipment had to be acid proof, or as nearly so as possible. Much time was spent on this phase of design. Wooden tanks, constructed of 4-in. thick Douglas fir, were selected for practically all process tank requirement. Staves are chamfered. Hoops are enclosed in polyethelyene sheets. Launders were built of wood fastened by stainless steel nails and bolts.

Agitators are Devereaux type with rubber covered shafts and impellers. Thickener mechanisms are rubber covered. Rake shoes are stainless steel. Thickener cones are rubber lined.

Pulp piping is rubber lined. Hoses are used where possible for pulp transfer because they are extremely satisfactory for handling both pulp and solutions.

Saran-lined pipe for solution handling has a definite advantage over rubber-lined pipe becase saran-lined pipe can be cut, threaded and flanged in the field. Rubber-lined pipe was factory-fabricated to exact lengths with matching flange bolt holes for assembly in the field as required.

In general, saran-lined pipe on pump suction and discharge manifolds followed by hoses for long runs is optimun for acid solution handling.

Pumps deserve special mention. Because of stockpile and tailing disposal considerations, an almost level site for mill construction was selected. This feature necessarily increased the number of pumps.

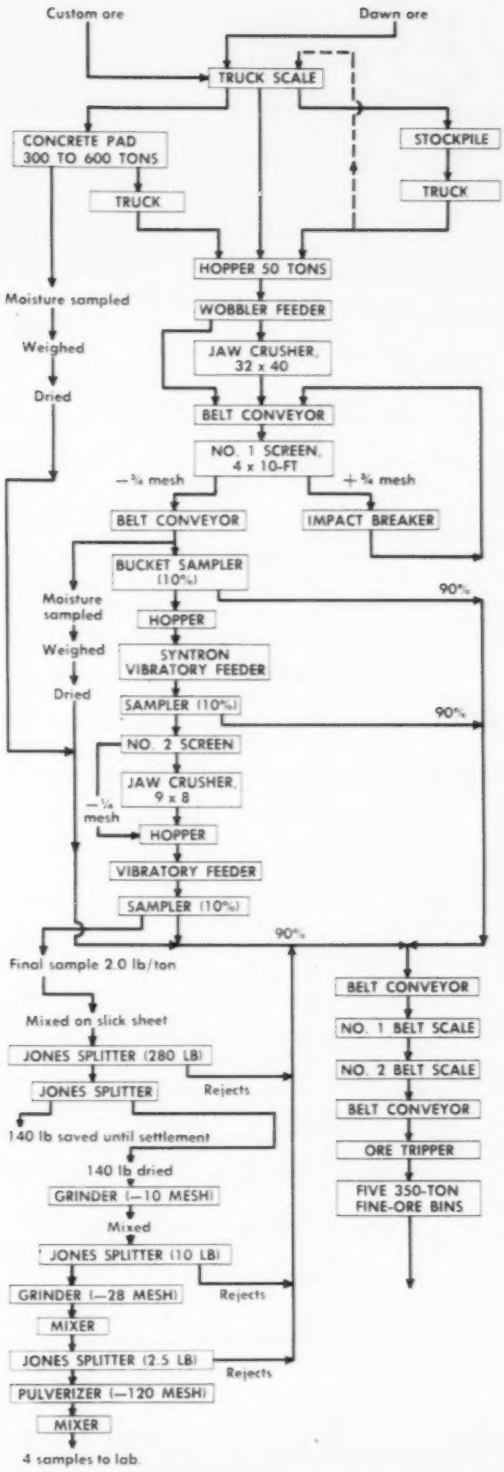
Several different types of pumps are in use. However, as much as possible, rubber lined Vacseals were specified for both pulp and solution. There are four sets of two centrifugal pumps (one and a spare) handling pulp. These pumps are equipped with Conoflow operators. Speed is controlled by air pressure differential obtained by a bubbler pipe inserted near the pump suction in the sump. Pulp levels can be controlled within one inch by the use of the Conoflow operator in connection with a variable speed drive.

Valves are another critical maintenance problem. Air operated diaphragm valves are used on the IX columns, hand operated diaphragm and pinch valves on other solutions. The only valves used on pulp lines are the thickener underflow valves. They are lightweight fabricated stainless-steel gate valves which have proved to be satisfactory from an operational standpoint. Other pulp valving is accomplished with wooden or rubber plugs.

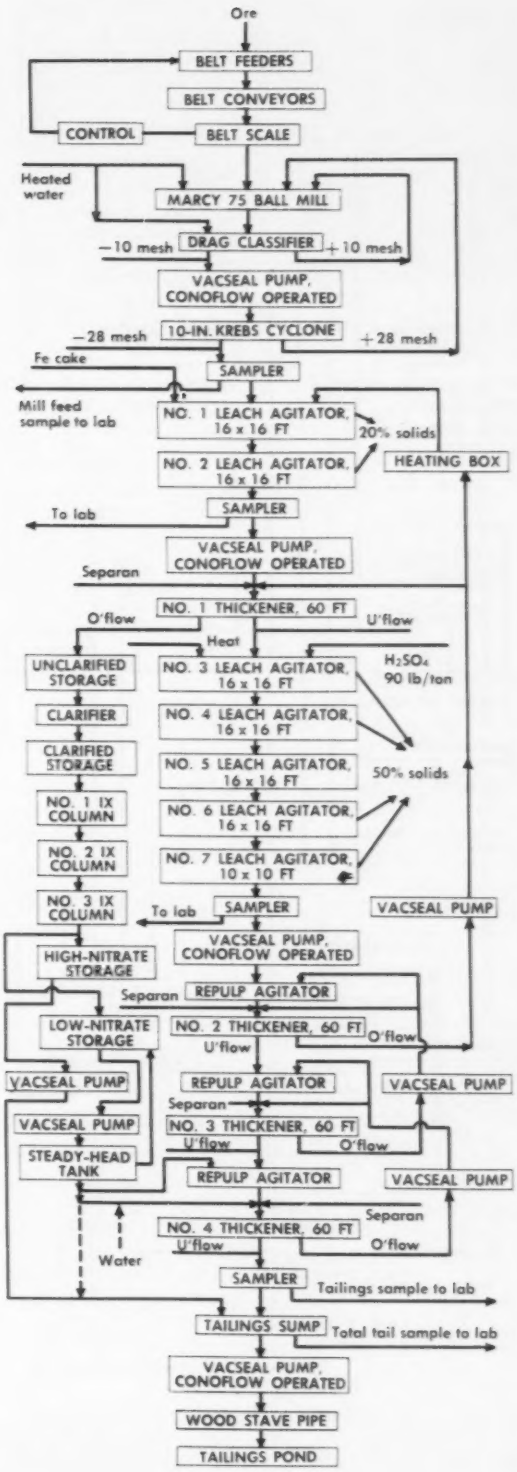
All electrical wiring was specified with neoprene cover. Cable trays are covered with Transite. Conduit, in general, is semi-rigid plastic pipe.

Power is supplied by the Washington Water Power Co. from a line that crosses company property. Power sources are the Long Lake and

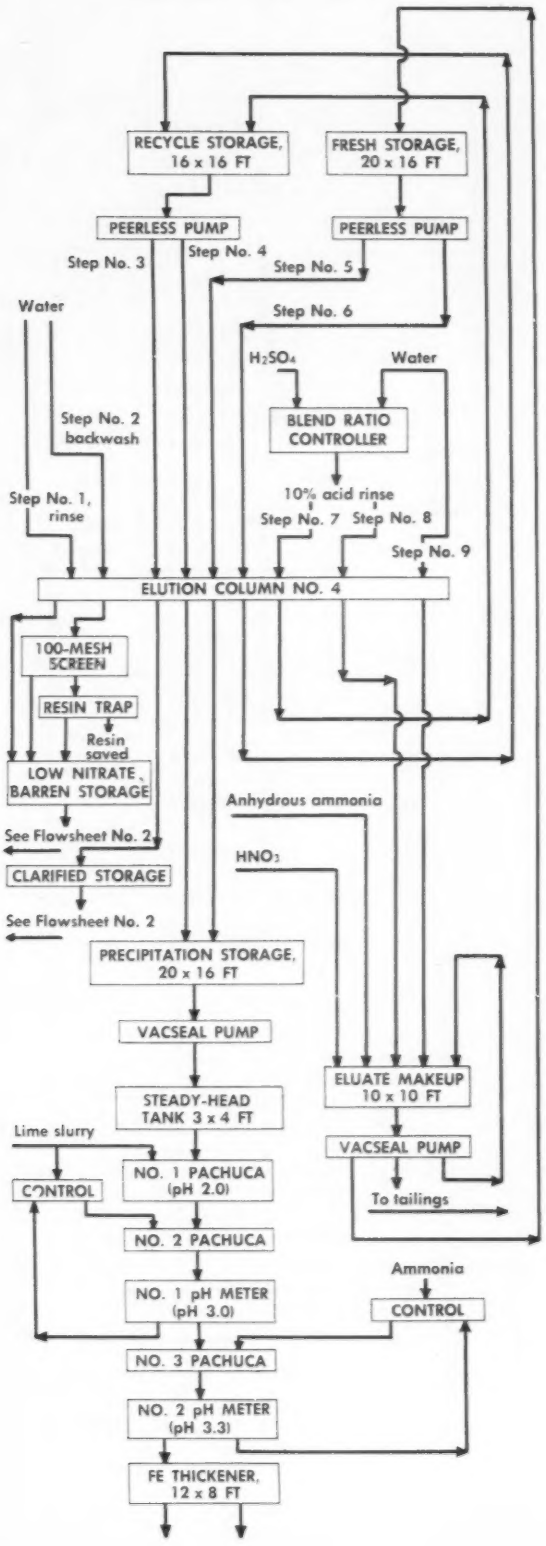
Flowsheet No. 1
Crushing and Sampling Plant



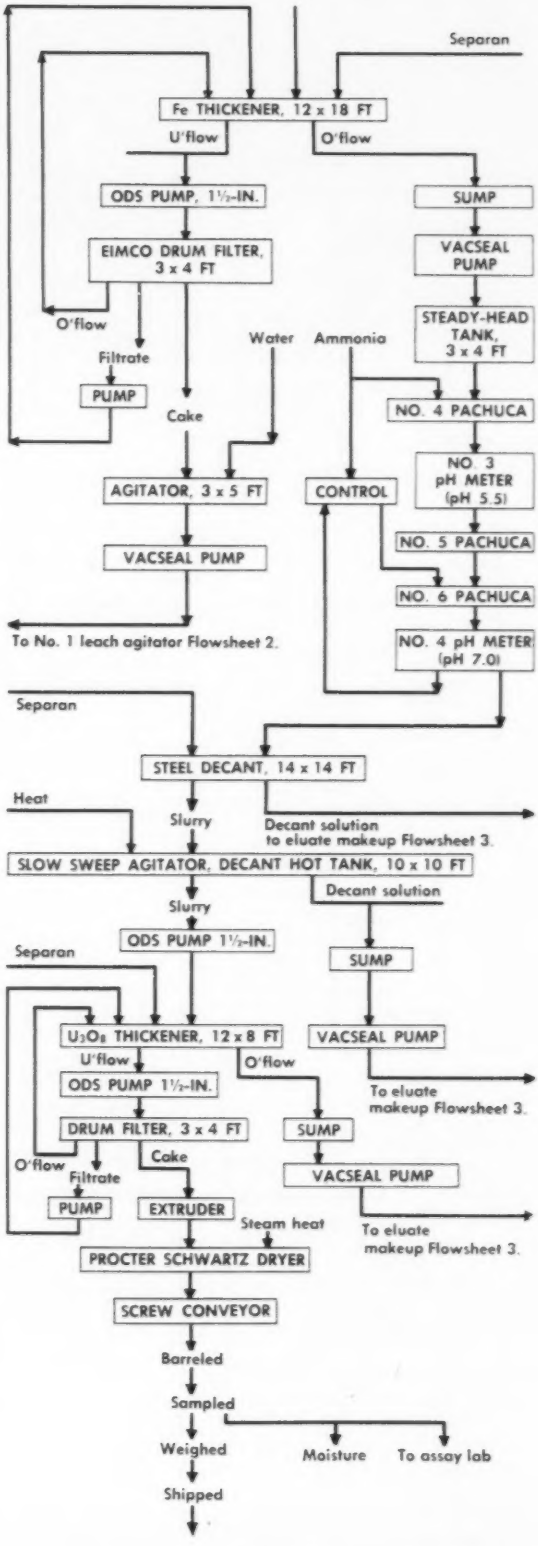
Flowsheet No. 2
Leaching Section

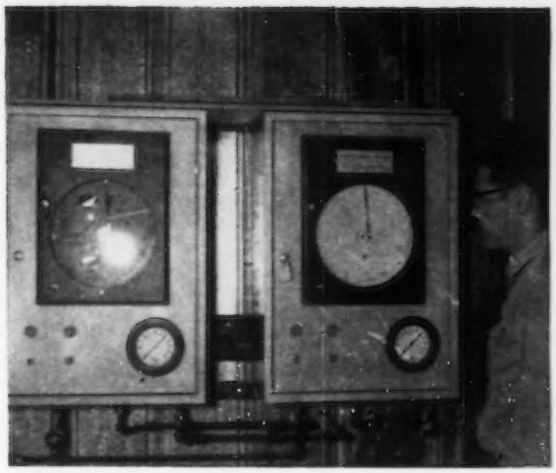


Flowsheet No. 3
Ion Exchange Section



Flowsheet No. 4
Precipitation and Drying Section





INDUSTRIAL ELECTRONICS unit permits careful control over crushed ore feed to the grinding-classification circuit.

AUTOMATIC CONTROLS regulate pumps which discharge ground ore through rubber hose to 10-in. Krebs cyclones.

Little Falls power plants on the Spokane River.

Water is furnished by a series of springs on company property approximately ½ mile from the plant site. A 100-gpm potable water and a 500-gpm plant and fire water line furnish ample water from a supply of nearly 1,000-gpm. Mill water supply and fire protection is assured by a 100,000-gal storage tank near the plant.

Several months' ore supply has been stockpiled at the mill. This ore is blended to achieve the optimum physical and metallurgical characteristics and the grade that is most profitable.

Custom Ore Handling

Custom ore is accepted, if it is found to be amenable to the circuit, in nominal lots of 500 tons. Ore is weighed on truck scales as it enters the yard. It is stockpiled on a 100x200-ft concrete slab. A moisture sample is taken and placed in a watertight container as the ore is being stockpiled. When a lot has accumulated, it is sent to the crushing and sampling plant.

The crushing and sampling plant is not unique in any way except for the use of a Universal Engineering Corp. Wobbler Feeder. This feeder was installed to help eliminate some of the trouble expected from wet, sticky ore. See sampling plant flowsheet. All sample cutting and preparation procedures have been reviewed and approved by the AEC. Custom shippers are paid AEC Schedule 5 (revised) prices according to ore grade. The ore, having been crushed and sampled, is delivered at minus ¾-in. to one of five mill bins by a conventional belt tripper.

Controlled Feed System

These bins are 20 x 40-ft steel tanks each having a live load capacity of 350 tons. They are discharged by means of slide plate type belt feeders. The belt feeders are installed in concrete tunnels under the center of each bin. The slot supplying each feeder is 2 ft wide x 17 ft long. Feeder belt speeds can be varied from 1- to 5 ft per minute by use of a Varitrol drive. The five feeders discharge onto a cross belt which in turn discharges onto the ball mill feed belt. Rate of total ball mill feed is controlled and recorded by a belt scale mounted on the ball mill feed belt. Individual feeders can be set to deliver any amount required, the balance is made up automatically by air pressure differential acting on the varitrol feeder drives. This feeder arrangement for ore blending is quite satisfactory.

Grinding and Classification

Grinding is accomplished by one Marcy 75 screen head ball mill discharging at approximately 78% solids. Discharge is diluted to 60 to 63% solids in a drag type esperanza classifier. Classifier overflow is pumped to a 10-in. Krebs cyclone. It is possible to maintain a 50% solids cyclone overflow without producing more than 2 or 3% plus 28-mesh material. This is sometimes difficult to do on hard ore without sacrificing tonnage. A typical screen analysis of the cyclone overflow is as follows:

+ 28 mesh	— 3.0%
+ 40 mesh	— 4.0%
+ 65 mesh	— 15.0%
+100 mesh	— 11.0%
+200 mesh	— 20.0%
−200 mesh	— 47.0%

The product varies somewhat with type of ore being ground. A fine grind is not necessary from a metallurgical standpoint but is most desirable from a materials handling standpoint.

High Extraction Achieved

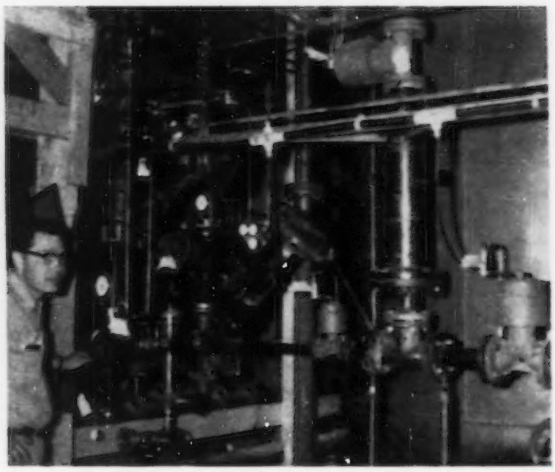
Several per cent better extraction than test work indicated has been achieved. Test work covered a wide range of acid strengths, material sizes, temperatures and retention times. Optimum economic conditions seemed to require a minus 20-mesh grind, 130 lb of H_2SO_4 per ton, agitation temperatures of 50 deg C and 16-hr retention time in a straight multistate agitation circuit to achieve 90 to 92% extraction. By using approximately the above conditions, but with a split leach circuit, over 96% extraction has been averaged in actual practice.

The split agitation circuit is set up to receive cyclone overflow in No. 1 and 2 Deveraux in series. Cyclone overflow is diluted to 18 to 20% solids by the addition of No. 2 thickener overflow solution. This solution was to be heated sufficiently to approximate a temperature of 50 deg C in No. 1 & 2 agitators. Free acid content of No. 2 thickener overflow averages about 6 gpl. Retention time is about two hours in the first two agitators. They are discharged by means of air lifts to prevent sanding at the low density.

Test work on this initial leach phase indicated 80 to 85% extraction. It has been difficult to achieve more than 75% extraction, mainly due to lack of heat. This is being remedied.

No. 1 thickener underflow is pumped at 60% solids to the second bank

AMOUNT OF RESIN needed to charge the four Dorrco ion-exchange columns is shown in the rows of containers.



OPERATION OF IX COLUMNS requires an intricate system of pumps, pipes, valves to control the multi-cycle process.

of five agitators. Make-up acid is added to the first of these at the rate of about 100 lb per ton of ore. Free acid strength in this second bank of agitators gradually declines from 35 gpl in the first to 15 gpl in the last of the series. Ferric iron content is approximately 6 gpl.

Overflow from the last agitator is pumped to a 4x5 ft repulper, diluted by No. 3 thickener overflow to about 20% solids and fed to No. 2 thickener. The acid and ferric iron balance in the solution is rather difficult to maintain, as the high concentrations of acid and iron which result in good extraction are not conducive to high resin loadings in the IX circuit. A reasonable balance is preserved and maximum resin loading is sacrificed for better extraction as long as there is sufficient time for elution.

Pre-plant construction test work as well as theoretically equating the solution values in the counter-current decantation circuit indicated less than ½ of 1% soluble loss. This loss was not greatly increased, theoretically, by use of the split agitation circuit as long as high recoveries are achieved in the first stage of agitation. Lower first-stage recoveries, of course, introduce more uranium into No. 2 thickener with attendant higher soluble losses from No. 4 thickener underflow. These losses, however, have not exceeded 1%. The good recovery has been achieved by maintaining approximately 60% thickener underflow densities and as much wash as can be handled by the IX circuit. No. 4 thickener wash solution is made up of IX low nitrate barren solution which is sometimes diluted with fresh water, if found necessary, to reduce ferric iron concentrations. In practice, proper ore blending will accomplish the same purpose.

Thickening and Tailing Disposal

The counter-current decantation circuit consists of four 60x12-ft thickeners. Underflow pulp is diluted from 60% to approximately 20% solids and repulped between each thickening state. The repulping step was found to be mandatory as the pulp flocs formed by the use of Separan carried soluble values through to tails if not thoroughly broken down.

Thickener underflow pumps are 6-in. duplex diaphragm low pressure type equipped with Reeves drives. Stroke length is left constant. Speed is regulated to adjust flow rates.

Tailing are pumped through 4-in. hoses and 4- or 5-in. wood stave pipes to a 50-acre tailing pond located about 1,000 ft south of the plant. Densities vary from 20 to 50% solids. There has been no trouble with the lines sanding. Wood stave pipe is banded with PVC covered wire to minimize corrosion should leaks occur. All tailings are impounded, including the solution.

Clarifier Discontinued

Ion exchange feed solution produced by No. 1 thickener overflow is as clear as can be expected. Colloidal slime fraction is difficult to filter out. A conventional leaf clarifier was installed to do so but was found to be a major problem as well as expense. Clarification, even of liquor that was visually clear, was found to be necessary for IX feed due to the fineness of the resin which acted as a filter and formed an impervious layer on top of the resin in the columns. The finer fraction of the resin was replaced with plus 40-mesh material. Unclarified solution is now fed to IX.

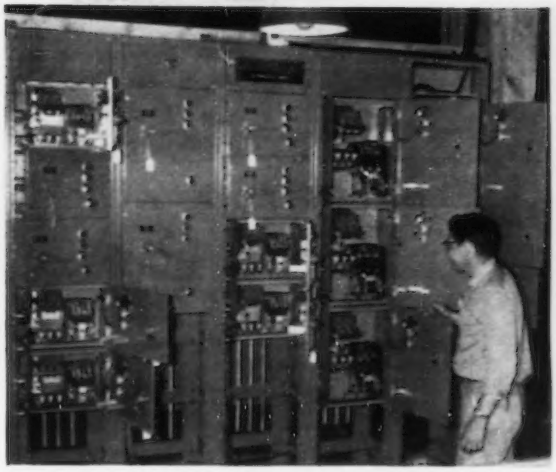
Slime accumulates all through the bed, some is carried out with the barren solution, the rest is backwashed out the top after each load cycle.

Column Ion Exchange

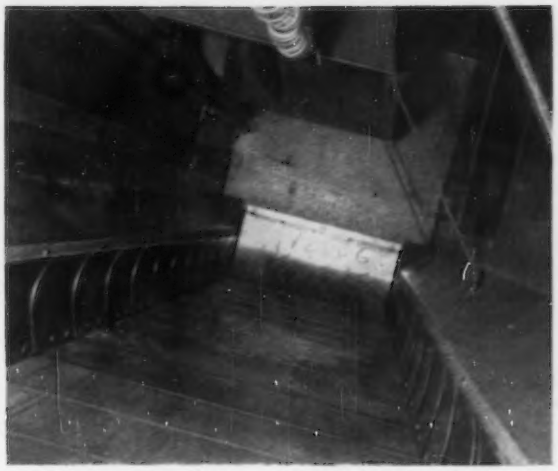
Ion exchange is accomplished in four 8x15-ft columns. Each column is equipped with a bottom distribution piping system overlaid by sized gravel and sand. The strong base anion resin rests on the sand and occupies a 270-cubic ft space up to the upper distribution piping. The resin is loaded with uranium as a uranyl sulphate.

Pregnant ion exchange feed solution is known to contain uranium ions, in at least four different forms, these are: the uranyl cation $UO_2{+}{+}$, un-ionized uranium sulfate UO_2SO_4, a divalent uranium complex $(UO_2(SO_4)_2)$ -2 and a tetravalent uranium sulfate complex $(UO_2(SO_4)_3)$ -4. Depending upon the amount of free acid and the concentration of sulphate and bi-sulphate, ferric iron and other competing ions, the resin usually adsorbs from 2.5 to 4 lb of uranium per cubic foot.

During the loading cycle there are three columns on stream. The lead column receives the solution at the top under pressure, it is then forced through the resin bed, then flows out through the bottom distribution pipes and up into the top of the next succeeding column on stream. Pressure drop through the column is an indication of the permeabiltiy of the resin bed. Pressure drops should be on the order of 15 lb per column. Flow rates in general are conceded to be 5 or 6 gpm per sq ft of column cross sectional area. To date it has not been possible to attain more than 6 gal per sq ft without unreasonable pressure development.



ELECTRIC CONTROL STATIONS are spotted at strategic positions in the plant. This one controls ion-exchange area.



A LOOK INSIDE of the Proctor & Schwartz dryer. Concentrates are heat-dried in the stainless-steel clad chamber.

Periodical uranium analysis of the effluent and comparison with the feed solution, using barren solution as a standard, establishes the degree of load in each column at any given time. In practice a column is considered to be loaded and ready for elution when the uranium content of the influent and effluent of the lead column are equal and the second column in line shows a breakthrough of perhaps 10% of the value of the IX feed solution. The third column strips nearly all of the remaining uranium from the solution, producing an almost barren effluent.

After a column is loaded it is rinsed with water. The rinse water displaces most of the solution, which continues on through the next succeeding columns. After rinsing, the column is backwashed. This step is accomplished by the addition of 200 to 250 gpm of water through the bottom distribution pipes. The resin bed is raised, loosened and resorted. Slime particles are carried upward and out with the backwash water. Fine resin has a tendency to be carried out in the ascending stream if the velocity is great enough. The backwash stream is run through a 100-mesh screen to trap any fine resin thus carried out of the column.

Actual Elution Begins

After the backwash has been completed the actual elution begins.Ammonium nitrate is used as the eluate. The eluate is made up from nitric acid neutralized by anhydrous ammonia to achieve the nitrate content. Excess nitric acid is added to maintain the proper acidity.

Eluate strength has varied from 50 gpl of nitrate and 25 gpl of acid to 30 gpl of nitrate and 25 gpl of acid. Curves have been of the elution cycle to determine optimum operating conditions.

The first eluate added to the column is pumped from the recycle eluate tank. This liquor contains from one to two gpl of uranium. It is added through the upper distribution pipe manifold, just above the top of the resin bed, and percolates downward. Flow rate varies from 30 to 60 gpm. The first bed volume, approximately 2,000 gal, is sent to the IX feed storage tank. This solution contains practically no acid, nitrate or uranium. As values begin to appear the effluent is sent to a concentrated eluate storage tank.

The curve taken from these eluate flows is very interesting. The uranium and acid curve start up together, very steeply, from one or two grams per liter to 20 or 25 gpl. The nitrate curve lags by some 1,700 to 2,000 gal and then it, too, rises abruptly as the nitrate requirements of the resin are nearly satisfied. The uranium curve drops almost as steeply as it rose until it is down to four or five gpl at which time it tapers off gently to the end of the elution.

The most concentrated portion of the eluate reports to precipitation storage. The next step is fresh eluate to precipitation and then fresh to recycle. This fresh to recycle step insures a more concentrated eluate to be precipitated. The last steps are acid rinse and water rinse. Acid used is sulphuric. The function of the strong acid rinse is to help regenerate the resin after each elution by removing interfering ions from sites which could be occupied by uranium when the column is put back on load stream.

Rohm and Haas Amberlite 400 anion resin is used. The nitrate capacity of this resin is about 4.2 lb per cubic ft. When a newly eluted column first goes on stream in the number three position, the first 10 bed volumes, approximately 20,000 gal, of effluent has a fairly high nitrate content. This portion of the barren solution is split out of the stream and reports to a storage tank where it is added gradually to the pulp tailings as a wash. Nearly all of the low nitrate barren solution is added to No. 4 thickener as wash.

Concentration ratio achieved in the IX step is approximately 20:1 under average conditions when the IX feed is assaying 0.5 or 0.6 gpl.

Precipitation

Concentrated eluate is pumped at the rate of 20 or 30 gpm, to the first of three 6x4 ft pachucas.

A 20% lime slurry is added to the first and second tanks. The first by hand valving, the second by means of an automatic controller-recorder pH meter. The third pachuca receives gassified ammonia regulated by another controller-recorder pH meter. Final pH in the third pachuca is 3.3 to 3.6 The lime slurry precipitates as gypsum and also precipitates nearly all of the iron as a ferric hydroxide.

Overflow from the third pachuca reports to a 12x8-ft thickener. Thickener underflow is pumped to a 4x3-ft stainless steel drum filter. Cake is repulped and returned to No. 1 agitator in the main leach circuit. This cake usually assays 1 or 2% uranium. The filtrate is returned to the iron thickener. The overflow from

(*Continued on p. 118*)

AT THE BASE of Pima's hoist system (3070 bench), Kenworth 802 22-ton truck takes 40-sec to dump into skip.

22-TON LOADED SKIP is then pulled over a 38 deg inclined track conventionally laid on wooden ties.

Skip Hoisting Solves Deep Pit Problem

DEALING WITH AN OREBODY that is both relatively narrow and steeply dipping caused Arizona's Pima Mining Co. to use a rockover skip system in conjunction with trucks for removing ore and waste from its open pit copper workings southwest of Tucson. Pima's orebody has an average width of 200 ft and current development indicates a lateral extent of some 1600 ft and a vertical depth of 640 ft on a 41 deg dip. The alluvium surface cover is level, making it impossible to take advantage of topography for access to the orebody.

A pit designed for mining an orebody of this type must be small in area and deep, requiring a large amount of stripping. Early study of the problem disclosed that the network of permanent haulage roads, some 50 ft wide and with grades up to 10%, needed for the removal of waste and ore from the pit by trucks alone and their eventual extension to the lower limit of the pit would call for excavation of an additional 3-million cubic yd of material. This great expense and the prospect of heavy tire, engine, and brake maintenance, coupled with the certainty of traffic problems on the long haulage roads, led the company to install its rockover skip system in March 1957. Pima's unit, including hoist, was designed and manufactured by the National Iron Co., Duluth, Minn. Electrical equipment was supplied by Westinghouse.

Skip system consists of a 60 ft steel headframe; and inclined double track down the side of pit on which 22-ton skips operate in balance; a steel structure at loading point to facilitate dumping ore and waste from trucks into spotted skip below; and a special double-drum hoist powered by four 500-hp motors.

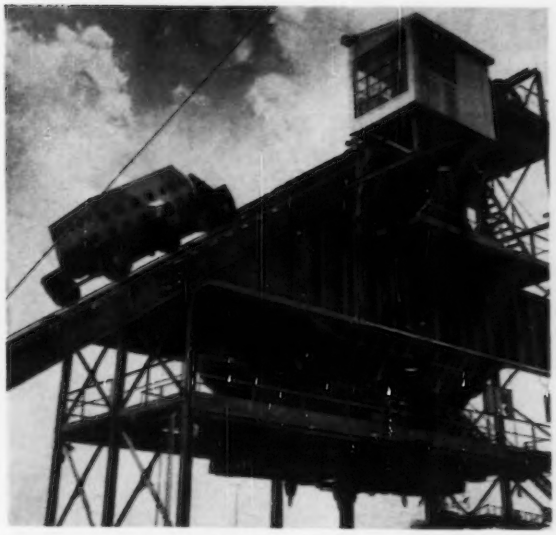
Northwall of pit, where skipway operates, has an over-all slope of 41 deg. Slope of skipway is held at 38 deg and this was done by slotting in on upper benches and by leaving a slight protrusion on the lower benches. Skipway bed, currently extending from the loading point on the 3070 level to the headframe point at the 3370, was extended while stripping, with sufficient subgrade to allow for ballast. Tracks were laid on wooden ties by conventional methods, with anchorage at the headframe.

Hoist Headframe

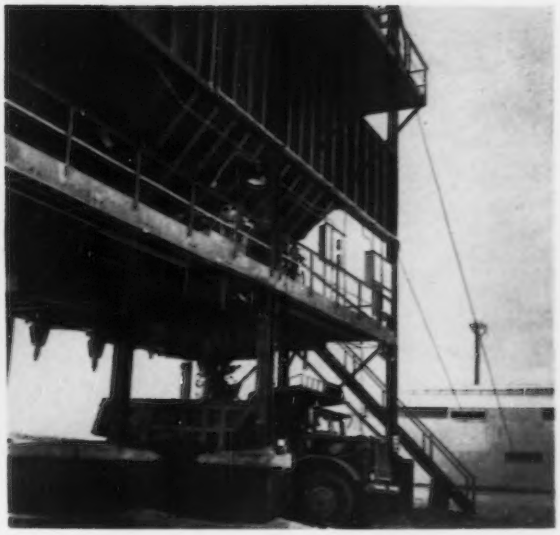
Steel headframe is almost at pit's rim and the 200-ton loading hoppers are built into it at about 45 ft above the ground. This permits simultaneous handling of ore and waste and their rapid loading into trucks spotted below by means of reciprocating plate feeders actuated by hydraulic cylinder. The twin tracks converge slightly at base of headframe and continue up it to permit automatic dumping of the loaded skips into the bins. These are separated by flop gates actuated by hydraulic cylinders, operated from the hoist control console, which direct the skip loads into either bin. In practice, it has been found best to hoist ore with one skip dumping into the same bin all the time. Since ore is only hoisted on the day shift, bin holding ore is emptied at end of day shift and then both skips and bins handle waste rock on afternoon and night shifts. Time required for loading a 34-yd truck spotted below the bin is 90 seconds.

Skip loading assembly at bottom of skipway consists of a pocket 18 ft below the loading bench. Depth of excavation provides sufficient headroom for trucks on the bench to dump directly into the spotted skips below. Excavation's side walls are reinforced by 6-in. pipe columns resting in drill holes and 2 in. lagging placed between them. A trestle-like structure, made from 10 in. pipe, spans the excavation and attached to this are adjustable deflector units to facilitate proper positioning of the load into the skips. Time required for loading one of the 22-ton skips is 40 sec. Installation's design is such that it can easily be cut free and moved as a unit to a new location. Pima plans to replace the structure with a drive-over arrangement which will cut skip time to 20 sec.

Body of the 22-ton skip rests on a 4-wheel, rectangular open frame chassis. To provide proper cushioning, all wheels are spring mounted, and rear axle is installed so as to pivot



TWIN TRACKS CONVERGE slightly at headframe base and continue up to permit automatic dumping into hoppers



HYDRAULIC cylinder-triggered reciprocating plate feeders in headframe's 200 ton hoppers control truck loadings.

centrally between the wheels, resulting in 3-point suspension for the chassis. As a result, the skip can traverse relatively uneven track at high speeds without danger of derailment. Skip body is pivot mounted within the chassis by a trunnion on each side at about the center of gravity of load, so that dumping the skip is just a rocking action of the body within the chassis. Both units are of welded double-wall construction with a network of diaphragms separating the two walls. This design provides the shock absorbing qualities required when loading direct from trucks.

Automatic skip dumping operation is accomplished by means of scrolls on dump plates carried adjacent to skip track on headframe above loading bins in the following manner: as the skip travels into dumping plates, body latches are first automatically released by a cam plate on dump plates, then dump wheels at lower end of each side of skip are carried through the scroll of the dump plates to rotate the body at proper rate and discharge the load.

Double-drum hoist serving the skip system does not follow standard mine hoist design. For instance, it is not equipped with regular post brakes, and control is effected both by the reverse "plugging" of the motors, and by electro-magnetic spring set brakes on each of the four motor shafts. Any one of the brakes can hold the stopped hoist.

The two hoist drums, each 8.2 ft in dia, a 7.8 ft wide face, and grooved for 1⅞ in. hoisting cables, are coupled by a gear-type clutch for adjusting skips. Power provided by four 500 hp, 1750 rpm, 4160 v, 3 phase, 60 cycle wound rotor motors is transmitted to the drums by two twin pinion gear reducers. Each has two input shafts from two motors and one output shaft to the drum. Gear ratio is 27:1.

Primary power control is full magnetic quadruplex reversing plugging with a 5-position reversing master switch, giving the operator hoist acceleration control (8 steps with 5 under control) and retarding control by plugging braking. Duplex magnetic control is available for single skip operation when adjusting skips with clutch disengaged. Normal meter demand is 700 kw integrated over a 15 min period. Highest peak demand is about 3200 kw, while normal power consumption will average 250 kw.

Skips' Safety Features

In addition to plugging braking, positive braking is made available by spring set shoe brakes on each motor coupling. Each brake affords 4,000 ft-lb torque. Release of brakes is effected by dc solenoids supplied by Rectox rectifiers. Automatic operational protection includes over speed; over travel; reverse travel; and brake malfunction. Each protective device is backed by a duplicate in the event of failure of first.

The hoist control console is installed in a booth or cab near the top of the headframe. From here the operator has full vision of the entire skip operation and complete control for normal hoisting operation, declutching and adjustment of skips, and operation of the flop gates for the storage bins. A squawk box communication system enables the operator to contact the skip tender in the pit, the storage bin feeder operator, and the near-by hoist house.

Capacity of skip system is estimated at 1,000 tph, when hoisting from the 600-ft level (2750 elevation). Actual production per shift currently averages 2,300 cubic yd. Total cycle time when hoisting from the 3070 bench loading point to the dumping point on the headframe at 3370 elevation is 67.4 sec, with 16 sec consumed by acceleration, 6.4 sec full speed (1650 fpm), 5 sec for deceleration, and 40 sec for loading and dumping. With an estimated reduction of loading time from 40 to 20 sec through adoption of the drive-over loading arrangement mentioned, this figure will be 47.4 sec.

The skip loading point on the 3070 bench is normally served by five 16-yd Kenworth 802 rear-dump trucks, and three 34-yd Kenworth 802-B Tractor-Trailer rear-dump units operate between the skipway headframe and the primary crusher or waste dumps. Round trip truck cycles currently average 5 and 6.5 min, respectively. Total truck equipment available includes seven 15-yd and four 34-yd units. This is in contrast to the 22 trucks, each with a capacity of 16 yd, estimated to be required to meet scheduled pit production hauling from the 420 level to the primary crusher and waste dump if the pit were designed for truck haulage only. Costwise, these trucks were considerably cheaper than the cost of the skipway. However, the operating saving afforded by the skipway will soon balance this cost difference.

NEW 3,000-ton concentrator in Pima County started operating late in December 1956, following extensive test runs on low-grade feed. Crushing plant is at center and right center. Flotation plant is to the left, with other buildings below.

How Scientific Exploration Found

JOHN B. HUTTL

BURIED BENEATH a 200-ft layer of alluvium in the Pima mining district, some 20 miles southwest of Tucson, Pima County, Ariz., lies a copper orebody which is now being mined by Pima Mining Co., but which would probably have remained hidden for some time to come had it not been for the development of modern prospecting methods.

It is perhaps the first orebody of any magnitude in western U.S. to be located by geophysical methods. Additional ore discoveries made since that time by other companies in the district, Duval Sulphur and American Smelting, promise to make it one of the great copper producing areas.

It all started back in 1949 when Robert E. Thurmond and W. E. Heinrichs Jr., interested United Geophysical Co., then headed by Herbert Hoover Jr., in a mineral exploration venture. After investigation and screening some 30 alluvial-covered areas in the West, they selected the Mineral Hill area in the northeastern part of the Pima district for exploration by geophysical methods. Here were found the desired guides generally used in selecting a region, namely, (1) known mineral occurrences. (2) history of past production. (3) type of host rock present, and (4) presence of favorable structure which could reasonably be projected into unexplored areas.

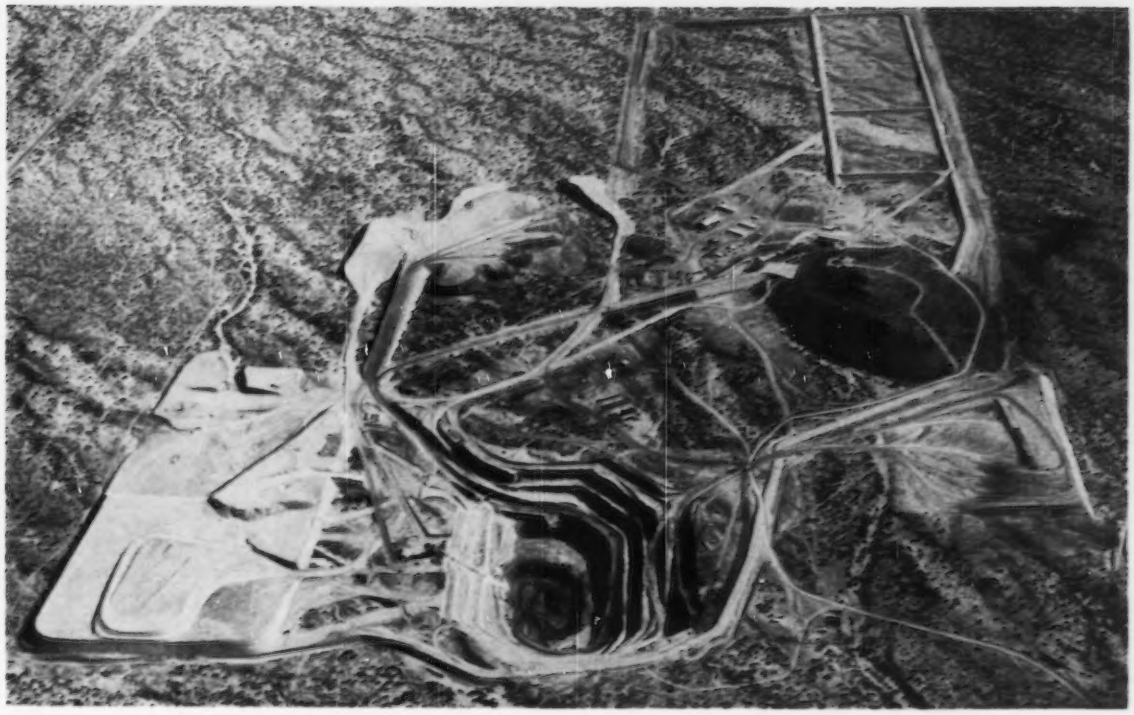
Pima's Active Past

Mining in the Pima district dates back to 1882. Since then and until shortly after the close of World War I, copper and silver ores were mined sporadically by underground methods, with small smelters in operation at Mineral Hill and Sahuarita. Activities were not resumed until World War II. Lead-zinc-copper ores were produced at the San Xavier mine and other small properties in the Sahuarita area of the district.

In 1951, Banner Mining Co. obtained an option on the idle Mineral Hill mine and reopened and rehabilitated the property with Government exploration assistance. A 400-ton flotation mill was erected in 1953. Capacity of the plant was increased by installation of additional grinding and flotation equipment after discovery and development of the Daisy orebody. Tonnage handled thereafter averaged 850 tpd.

In addition to the Banner and Pima operations, Duval Sulphur is developing its holdings to the south, including construction of a 10,000-tpd concentrator. An expenditure of about $20-million is involved. Total production for the district is estimated at more than $20-million in copper, lead, zinc, silver gold and molybdenum.

United Geophysical Co. incorporated Pima Mining Co. in 1951 shortly after discovery of the copper orebody mentioned. An underground development program involving the sinking of a 400-ft shaft to explore the ore zone on the 300 and 400 levels was initiated in January 1952. Shaft was subsequently deepened to 600 ft, with lateral exploratory work carried out on the 500 and 600 levels. On Aug. 8, 1955, Cyprus Mines Corp. exercised its option on the property and assumed management of Pima Mining Co. Union Oil Co. and Utah Construction Co. have a 25% interest each.



OVER 9-million cubic yd of burden were removed from the pit before mining started. Pit is served by 38 deg Rockover skipway (center foreground). Flotation plant and general offices can be seen at upper left with tailings pond beyond.

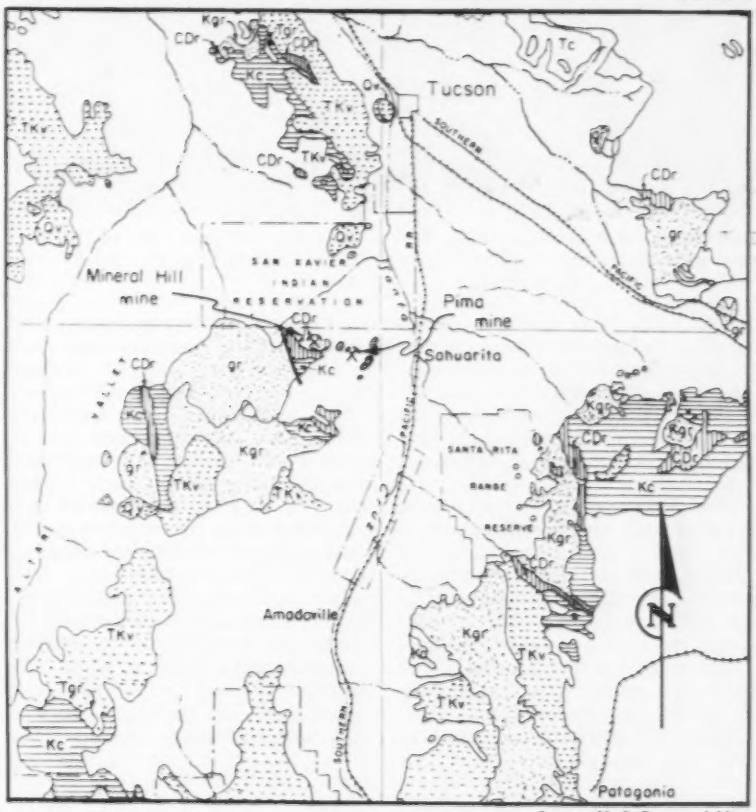
Pima Mine

Ore Occurs Along Fault

Most prominent physiographic feature of the Pima district is the Sierrita Mountains. According to W. R. Storms and A. B. Bowman (Bureau of Mines IC 7786), these in general are composed of a granitic core with metamorphosed sedimentary rocks on the west slope and much less altered sediments on the east. Coarse-grained intrusive igneous rocks, ranging from granite and quartz monzonite to granodiorite, underlie much of the eastern piedmont. Some intrusive dikes cut the sediments and probably are related to the granitic intrusion.

Regional structure has been complicated by folding, overturning, low-angle thrust faulting, and steeply dipping faulting. Sedimentary rocks, ranging from Cambrian to Cretaceous in age and consisting principally of limestones, shales and quartzites, outcrop in the vicinity of the Mineral Hill mine. Farther eastward these rocks are covered by surface material, which is some 150 ft deep at the eastern property line.

These sediments have been intruded by granite underlying much



Source—U. S. Bureau of Mines

LEGEND—Qv Quaternary volcanics; TKv-Tertiary volcanics; Kgr-Cretaceous intrusives; Kc-Cretaceous limestones; CDr-Devonian limestone; gr-Precambrian granite.

STRIPPING alluvium covered zone to depth of more than 200 ft is done with 18-yd Caterpillar 470 bowl-scraper assemblies. 7,000 cubic yd are stripped daily.

REPAIRS as well as major overhauls of earthmovers, lubrication and washing are done at predetermined schedule in the mine shop. No recapping is done at the mine.

of the area and cut by several porphyry dikes. A large east-west pre-ore thrust fault, known as the Mineral Hill fault, transverses the area for almost 5500 ft. At places the fault strikes almost northwest, but the general trend is east-west. It dips about 3 deg south.

Ore mineralization occurs along this large fault, usually at intersections with cross faults, or at or near intrusive contacts with limestone or quartzite. Structural relations of Mineral Hill were a lead to the exploration of the alluvial-covered Pima area.

Mineral Hill copper deposits are of the contact metamorphic type, usually occurring sporadically along shear zones in the limestone and also disseminated through the contact silicates. Chalcopyrite is the principal ore mineral, although small amounts of bornite and chalcocite also occur. Some magnetite, pyrite and small amounts of sphalerite, molybdenite and scheelite are found. Gangue consists of limestone, quartz, pyrite, hematite, calcite and contact silicates.

Two distinct types of ore are found in the Pima deposit, namely, (1) a highly altered limestone, strongly mineralized and relatively high grade, and (2) low-grade disseminated ore mineralization in metamorphosed volcanic sediments. High-grade material occurs in what was originally a dolomitic limestone thoroughly altered by igneous action to a calcium silicate rock called hornfels which was subsequently impregnated with the ore minerals.

Low-grade ore is found in the thick series of detrital rocks, essentially by a mixture of sediments and volcanic material of pyroclastic origin, enclosing the hornfels band. As at Mineral Hill, principal ore mineral is chalcopyrite. Also present in small amounts are sphalerite and molybdenite. Pyrite and magnetite are accessory minerals.

For a short distance below the bedrock surface, the copper sulphides have been oxidized to form the green copper silicate, chrysocolla, and the black copper oxide, tenorite.

Uncovering a Magnetic Anomaly

All of the geophysical work started in 1949 was done with hand instruments. Magnetic tests were made by running long grid or profile lines at 400-ft intervals and at right angles to a base control line, with readings taken every 12½ ft, 25 ft,, or 50 ft, depending on relative changes in the observed field intensity.

These operations disclosed an extensive magnetic anomaly off the alluvial-covered eastern flank of Mineral Hill. Subsequent to the delineation of the orebody by hand geophysical methods, both magnetic and electromagnetic, some work was done with a mobile magnetometer, but it did not discover anything of value over and above that which had been previously delineated.

Final geophysical analysis suggested that the orebody was a lenticular-shaped deposit dipping steeply to the south and striking nearly east-west. Subsequent drilling and the underground development work mentioned before confirmed these findings.

The first drill hole encountered bedrock and oxidized mineralization at 209 ft and sulphide ore at 255 ft. Samples of rock below the bedrock were found to be highly magnetic and good conductors. To date, the ore deposit has been developed over a lateral extent of 1600 ft. Its lower limits have not been determined, but drill holes have intersected the formation at vertical depths of 800 ft.

Dip is about 45 deg to the south and the general strike is east-west. Thickness is estimated to average 200 ft. The mass of low grade disseminated ore mentioned, which shows no well-defined structural form, is found to the east and northwest of the main high-grade orebody.

Why an Open Pit?

Underground development program carried on from January 1952 until about the middle of 1954, during which time some 70,000 tons of ore averaging 6% Cu were shipped to the El Paso smelter, made it apparent, and subsequent study proved, that the ore deposit could be worked more profitably by open pit methods if the halo zone of disseminated low-

grade material surrounding the orebody were combined with the general orebody. Decision to do this was made soon after Cyprus Mines took over the property from Union Oil in the fall of 1955.

The fact that the orebody is narrow and not very large meant that the pit to be developed would be relatively small in area and deep, requiring a large amount of stripping. To develop the mine to a point where 3500 tons of 1.89% Cu ore could be sent daily to the crusher, an estimated 9-million cubic yd of waste would have to be removed.

The type of haulage system to install was another problem confronting the management. Study disclosed that use of straight truck haulage requiring an elaborate system of haulage roads would entail excavation of an additional 3-million cubic yd of alluvium and waste. This expense was eliminated by installing a rockover skip system.

Stripping operations were done under contract by Utah Construction Co. The work started in November 1955 was completed in October 1956. About 6-million cubic yd of material was excavated and moved during this period. Equipment employed included MRS tractor units and 34-yd Wooldridge scrapers in conjunction with a shovel-truck setup consisting of Marion 151-M shovel and four LLD Euclid trucks.

Pima Mining, planning to take over operation of the pit after Utah Construction completed its stripping contract, placed an order for equipment late in 1955 and commenced stripping work alongside the contractor in April 1956.

First official production was made on Jan. 1, 1957. During this eight-month period, Pima stripped about 3-million cubic yd of material. Additional stripping in progress along the south and east sides of the pit since early 1957 will develop additional ore by the time that opened up by the initial stripping is mined.

Mining Methods

Daily pit production amounts to some 13,700 cubic yd, of which 1700 cubic yd (4,000 tons) represents ore trucked to the concentrator, 5,000 cubic yd rock stripping and oxidized ore, and 7,000 cubic yd alluvial stripping. Equipment available to handle this output includes three B-E 54-B 2½-yd Diesel shovels; seven 16-yd Kenworth 802 rear-dump trucks; four 34-yd Kenworth 802-B tractor-trailer rear-dump trucks; one D8 Caterpillar dozer tractor; and a B-E 40-R rotary drill, all for ore mining and rock stripping. Six DW-21 Caterpillar scrapers; two D8 Caterpillar tractors (push cats); and a D8 Caterpillar ripper-dozer tractor are used in stripping alluvial. Auxiliary units consists of a No. 12 Caterpillar grader; 3500-gal GMC water truck; 1½-ton GMC flatbed truck; two ¾-ton GMC pickup trucks; wagon drill; and three 5-kw Kohler light plants.

LOADING in the pit is done with 2½-yd diesel-powered 54-B Bucyrus-Erie shovels equipped with torque converters. Kenworth 802 22-ton trucks haul ore from the pit.

Early in May 1957, mining had progressed to the 3070 level, which is roughly the top of the sulphide ore zone, with a drop cut started below this level to the 3030 level. Pit development is laid out for a final overall slope of 1.2:1 in the alluvium and 1:1 in the rock. The benches in the alluvium are carried at a height of 50 ft, with width at the base of the alluvium 85 ft. Those in the ore and waste rock zones are 40 ft high with final benches alternately 10 ft and 40 ft wide.

Holes for bench drilling are put down with the rotary drill on 18- to 24-ft centers to the next lower bench plus 3 or 4 ft. Holes are 9-in. in diameter, and the average horizontal distance between each hole and the toe of the bench is 21 ft. Bits used both in rock and alluvium requiring blasting are Hughes W7R Tricones. Drill puts down about 400 ft plus of hole per shift, and average life of the drill bits exceeds 2,000 ft. Sinker drills and the wagon drill are used, respectively, for blasting unwieldy boulders and for relieving excess burden, where necessary, at the toe of the bench.

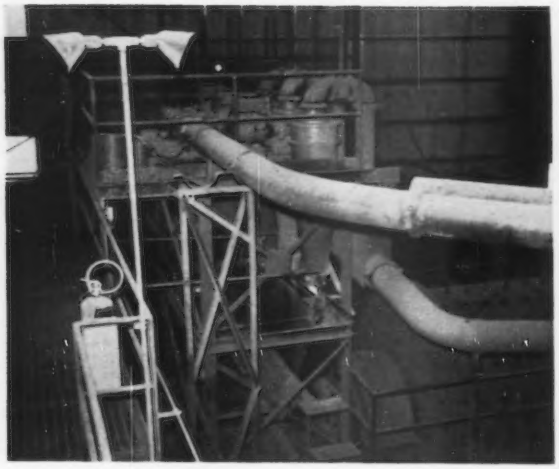
Drill holes are loaded with Carbamite powder, with Primacord tied to a dynamite primer at the bottom of each hole to detonate the charge. The loose end of the Primacord projecting from the hole is tied to the Primacord trunk line running the length of the line of holes. Powder load in the holes varies from 5/10 to 5/10 lb to the cubic yard. Overall powder factor, including backbreak, is about 0.5 lb per cubic yd. Fragmentation obtained is good. Secondary drilling and blasting is nominal. These operations, whenever needed, are carried out on one shift, with two men employed.

In sections of the pit where a horizontal layer of very dense conglomerate occurs between the bedrock and the alluvium, fragmentation has been materially improved by drilling smaller holes at shorter spacing and using a stronger powder.

Holes are drilled with the 40-R rotary unit fitted with a special collar to permit use of 4¾-in. Hughes W7R Tricone bits, and blasting is done with 40% bag powder. Hole spacing is 6x8 ft. Powder consumption is about 1 lb per cubic yd. The powder is brought well up the hole, resulting in better distribution of the explosive through the conglomerate.

Broken rock is loaded by three 2½-yd diesel shovels at a rate of about 2,600 tons per shovel shift. At each loading point, it is attempted to have trucks constantly backed on either side of the shovel, one being loaded, one waiting. Six shovel shifts are operated each 24-hour day, with two shovel shifts operating each shift. Operator keeps track of the number of trucks loaded. Percent shovel availability averages 96.4 .

A fleet of seven 16-yd rear-dump trucks is used for hauling ore and waste material from the shovel load-



FINAL grinding is done in 10½x13 ft ball mills on 900 hp and closed by two (plus one standby) Krebs cyclones.

ROUGHER flotation section consists of twelve 66-in. Fagergren machines arranged in three rows of four cells each.

ing stations to the truck dumping installation on the 3070 level serving the rockover skip system. Haulage between the receiving hoppers in the headframe of the skip system at the edge of the pit and the crushing plant or waste dumps is done by four 34-yd rear-dump tractor-trailer units.

Average percent truck availability is 85%. Haulage distances range from 1 to 1.35 miles. Maintenance of haulage roads receives careful attention at all times, because management and supervisors well understand the importance of this work. Large tires used on the trucks and other earth-moving equipment bruise easily despite their size, and represent quite a capital investment.

The most novel feature of the pit is the skipway system installed on the north side of the pit. It is perhaps the only one in operation in the west, and design follows closely that of several large units found in the iron mining areas of Minnesota.

Although design details and operation are described in a separate article, a few highlights will be of interest.

Built by the National Iron Co., Duluth, Minn., the skipway consists of two 22-ton skips operating in balance on separate tracks; steel truck dump structure at bottom of tracks; 60-ft steel headframe with receiving hoppers, one for ore and the other for waste; and a double-drum hoist of special design powered by four 500-hp motors. Slope of skipway proper is held at 38 deg. Distance between the truck dumping installation on the 3070 level and skip dumping point near top of the headframe is about 300 ft. Ore and waste materials hoisted per shift averages 2,300 cubic yd.

The repair shops serving the pit are near the general office and warehouse. Machine shop, garage, welding shop, lubrication building, and others contain up-to-date equipment and tools. Here both repairs and major overhaul of the various trucks, shovels, tractors and other earth-moving machinery can be carried out. Lubrication, greasing and washing of pit equipment is done at pre-determined intervals. No major tire repairs, such as recapping or vulcanizing, are carried out at the shops.

Operations at the mine are conducted on a three-shift basis, with the average working crew consisting of 114 men, including supervisory personnel. The number of men employed on maintenance, including supervision, is 41.

Concentrator Treats 3,000 tpd

The treatment plant installed a short distance from the pit consists of three separate units connected by appropriate belt conveyor system—primary crushing plant, secondary crushing plant, and concentrator proper. As designed, capacity is 3,000 tpd of sulphide ore, but there is room for addition of extra equipment should an increase in capacity be desired in the future.

In plant layout and arrangement of equipment to accomplish economical upkeep and low operating costs, the designers have drawn on the experience gained in the design and construction of other modern concentrators. All buildings are steel-frame structures covered with corrugated iron sheeting resting on concrete foundations.

Tuning up operations with plant feed consisting of low-grade material assaying a fraction of one percent copper were started on Dec. 24, 1956. Since then the concentrator has operated continuously on a three-shift basis treating more than 3,000 tpd.

Heads during the first half of 1957 averaged 1.78% copper (sulphide, 1.66%, and oxide, 0.12%). Treatment the ore receives in the crushing plants and concentrator, and equipment used are indicated in the accompanying flowsheet.

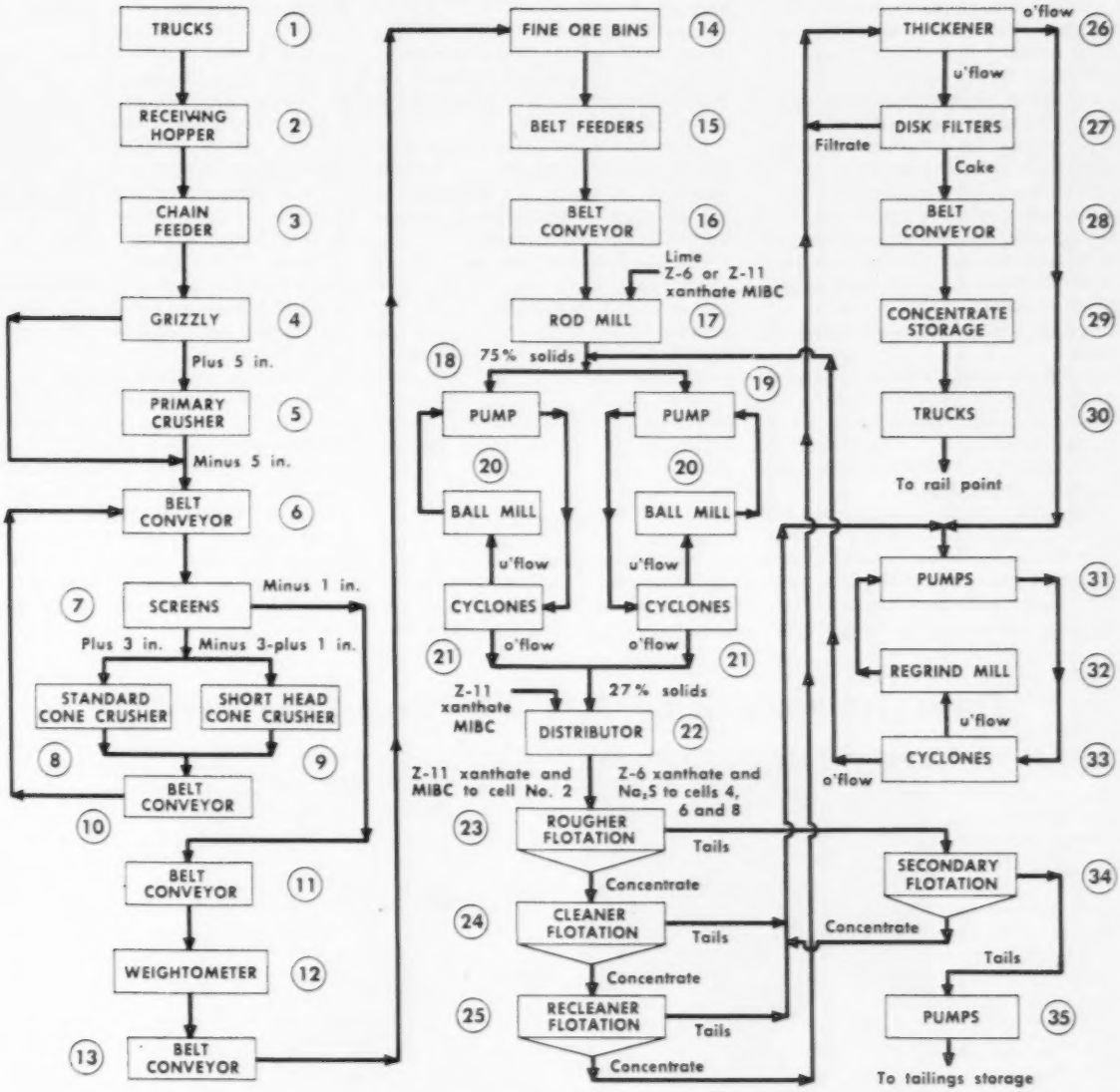
One interesting feature will be apparent, namely, substitution of cyclones for mechanical classifiers in the ball mill and regrind circuits. This practice is new in Southwestern concentrators and its effectiveness is now under study. Provisions have been made for scalping classifiers to remove tramp oversize should they be required in the future.

Pit ore brought from the loading bins at the skipway to the receiving hopper at the primary crushing plant by the 34-yd trucks is reduced in three stages to minus 1-in. rod mill feed. First reduction to minus 5-in. is made in a large jaw crusher served by a Ross chain feeder. Crushed material goes via belt conveyor to the secondary crushing plant.

Here are available a 7-ft standard cone crusher and a 7-ft short-head cone crusher for carrying out the two-step reduction of the primary crusher product to rod mill feed. Crushers operate in closed circuit with two double-deck vibrating screens installed ahead by means of a scissor conveyor leading to the main belt conveyor operating between the two crushing plants 300 ft apart.

Final minus 1-in. screen undersize is belt conveyed to the two steel fine-ore bins, each with a capacity of from 2,000 to 2,500 live tons. Feed

PIMA MINING CO., PIMA COUNTY, ARIZ.
COPPER CONCENTRATOR FLOWSHEET



LEGEND

1. Kenworth 802-B 34-yd tractor-trailer trucks
2. Receiving hopper
3. Ross chain feeder
4. Bar grizzly, 4- to 7-in. openings
5. Birdsboro-Buchanan 66x84-in. H-Type C-DF jaw crusher
6. 54-in. belt conveyor, 350-ft centers
7. Two W. S. Tyler double-deck F-900 Tyrock screens.
   Top deck, 3x18 in. Bottom deck 1x1 in.
8. 7-ft standard Nordberg cone crusher
9. 7-ft short-head Nordberg cone crusher.
10. 36-in. belt conveyor, 220-ft centers
11. 36-in. belt conveyor, 180-ft centers
12. Merrick Model E Weightometer, 600 tph capacity
13. 36-in. belt conveyor and L-B tripper, 125-ft centers
14. Two 50-ft diameter steel fine-ore bins. Capacity 2,000 to 2,500 live tons each
15. Four 30-in. belt feeders, 45-ft centers.
    Speed controlled automatically
16. 30-in. belt conveyor, 70-ft centers
17. Allis-Chalmers 10 x 13-ft rod mill
18. Two Hazelton 10-in. pumps. Variable speed drive.
    Type CT
19. Two American Manganese 10-in. steel pumps.
    Variable speed drive. Type T
20. Two Allis-Chalmers 10½x13-ft ball mills
21. Set of three Model D-20-B Krebs 20-in. cyclones (6 total)
22. Distributor
23. Twelve 66-in. Fagergren flotation cells arranged in 3 rows of 4 cells each
24. Five 66-in. Fagergren cells in one row
25. Four 66-in Fagergren cells in one row
26. 50-ft Dorr-Oliver thickener
27. Two Eimco Agidisc filters. Seven disks, 6 ft diameter
28. 18-in. belt conveyor, 140-ft centers
29. Concentrate storage
30. Trucks to rail point
31. Canadian Allis-Chalmers Type SRL 10-in. sand pumps
32. Allis-Chalmers 7x12-ft ball mill
33. Six Model D-10-B 10-in. Krebs cyclones
34. Eighteen 66-in. Fagergren flotation cells arranged in 3 rows of 6 cells each
35. Canadian Allis-Chalmers Type SRL 10-in. tailings pumps

to the rod mill from these bins is automatically controlled by four belt feeders.

Principal equipment installed on the grinding floor for producing flotation feed consists of a 10x13-ft rod mill with spot feeder driven at 15.55 rpm by a 900-hp synchronous motor and two 10½x13-ft ball mills driven at 15.1 rpm by 900-hp synchronous motors, each operating in closed circuit with two of three cyclones.

Cyclone overflow represents feed for the rougher flotation section, and the underflow feed for the ball mills. Rod mill product is discharged at 75% solids. A screen analysis covering it is given in one of the accompanying tables.

Flotation feed flowing by gravity to the rougher section contains 27% solids, and pH in the flotation circuit is maintained at 11.5. Practice differs little from that used in other Arizona copper concentrators.

Rougher operations are carried out in 12 flotation cells arranged in three rows of four cells each. Concentrates produced are successively treated in five cleaner cells in a row and four recleaner cells in a row. Rougher tailings go to the secondary flotation section consisting of 18 flotation cells arranged in three rows of six cells each.

Final concentrates from the recleaner cells go to a 50-ft thickener, with the underflow being treated on a disk filter, and the overflow going to the middling pump.

Filter cake is belt conveyed to storage, whence trucks haul it to the rail station at Sahuarita for shipment to the El Paso smelter. Filtrate is returned to the 50-ft thickener.

Tailings from the cleaner and recleaner circuits and concentrates from the secondary flotation section are pumped to six 10-in. cyclones in the regrind section. Cyclone overflow is pumped back to the primary ball mill-cyclone circuit, and the underflow goes to a 7x12-ft regrind mill driven by a 300-hp synchronous electric motor.

Reagents

Points of addition when treating regular sulphide ore are as follows: To the rod mill lime (6 to 6. lb/t); Z-11 xanthate; and MIBC. The distributor receives Z-6 and/or Z-11 xanthate and MIBC. When mill heads are composed of mixed ore—sulphides and portions of oxide minerals consisting of malachite, azurite, chalcocite, and native copper—then Na_2S and Z-6 xanthate are added to No. 4, 6, and 8 rougher cells and Z-11 xanthate and MIBC to No. 2 rougher cell in addition to the regular sulphide flotation reagent setup.

Total recovery in concentrate is 87.82% Cu. and tailings run 0.25% Cu. Concentrates shipped to the smelter assay 25.56% Cu and 3.27 oz/ton Ag. Molybdenum present in the ore in small quantities is not recovered at the present time but may be in the near future.

In addition to those men pictured below, *E&MJ* would like to thank the following men at Pima for their many courtesies extended during our visit: W. J. Rundle, assistant to the general manager; J. F. Olk, chief mine engineer; M. Nicholson, mechanical superintendent; J. A. Journeay, geologist; A. Beebower, electrical superintendent; D. T. Tremper, office manager; and Harry Eckstein, purchasing agent.

These Are Some of the Men Who Keep Pima Purring

Paul W. Allen
Vice president and general manager

E. D. Spaulding
Resident manager

R. E. Thurmond
Mine superintendent

George Komadina
Mill superintendent

R. E. Hernlund
Metallurgist

Electrolytic Zinc's Calcine Leaching

THIS IS THE SECOND ARTICLE in an operational series from Electrolytic Zinc Co. of Australasia Ltd.'s *E.Z. Review*. In October 1957 (pp 78 to 81), *E&MJ* described the company's zinc concentrates roasting procedure. This article will outline Electrolytic Zinc's solution preparation and purification in its leaching division.

Calcine, screened in the Roasting Division, is transported by belt conveyor to an 80-ton holding bin on the uppermost floor of the Leaching Division. Leaching operation is carried out continuously in a series of five celery-top pine tanks (pachucas). These are interconnected near the top by wooden launders. Each pachuca has a 12 ft dia and made from 33 ft 8 in. long and 3 in. thick staves held in position by steel hoops, and each has a conical wooden bottom ending in an outlet plug through which compressed air enters to agitate the contents. A centrally placed vertical woodstave pipe in each pachuca acts as a rising main to agitate and circulate the contents.

To the leading pachuca is added calcine delivered from the holding bin by belt conveyors, and spent electrolyte (containing about 10% sulphuric acid) piped from the Electrolytic Division. Sufficient quantities of both calcine and spent electrolyte are added so that the mixture emerges from the last pachuca at the correct acidity for subsequent classication and purification.

During leaching, most of the zinc oxide in the calcine is dissolved by the acid to form zinc sulphate from which metallic zinc is ultimately obtained. Along with the zinc, there is also taken into solution iron, aluminum, silica, arsenic, antimony, copper, cadmium, silver, cobalt and chlorine —all of which have to be removed or controlled in the subsequent operations—as well as several non-toxic impurities. The undissolved portion is a mixture of zinc oxide not dissolved during the leaching; zinc sulphide, not oxidized during roasting; and zinc ferrite.

Partial separation of larger and heavier particles is first accomplished in a Vee-Classifier, a V-sectioned box fitted with six bottom outlets, and then in six rake classifiers, each having two "ladders" with 50 bronze rakes.

Separation in the Vee-Classifier is done by distributing the pulp over as wide a surface area as possible and then relying on the gravity of the solids to clarify the liquid. Rake classifiers are called upon to deal with a thicker pulp and consequently some mechanical separation is necessary. Two rake arms or ladders are driven in such a way that settling is speeded, the heavier particles being pushed out by the rakes and finer ones carried into the overflow.

Overflow or clearer liquor from the Vee-Classifier joins the overflow from the rake classifiers and both flow to the primary thickeners for further clarification. Underflow from the rake classifiers is treated in the granular flotation section for recovery of zinc oxide and zinc sulphide.

Classification by Thickening. Solution going forward from the classification contains finely-divided solids, which, if they are not settled, represent a loss of zinc from the circuit.

To achieve settlement, overflow from the classifiers is divided between eight primary thickeners. Each thickener is a lead-lined wood vessel, 50 ft in dia and 15 ft deep with a flat concrete bottom, near the center of which is attached a conical outlet for the collection and discharge of the settled pulp.

Settlement is aided by a slowly rotating raking mechanism so sloped that settled solids, which have formed a conical bottom, are discharged towards the center outlet. Settled pulp is discharged by airlifts to holding tanks. About one-third of the pulp so settled is forwarded to the Residue Treatment Division for recovery of further zinc and the remainder, after filtering, washing and drying, is either placed on a storage dump or sent to the wharf for shipment to Port Pirie.

Clarified solution forms the top zone above the settling pulp and is withdrawn from the thickener in a wooden launder suspended internally so that the clearest solution is drawn off continuously.

To achieve good settlement, pulp fed to the thickeners must be of the correct gravity and acidity. Recently, settling aids added to the primary thickener feed have produced a clearer overflow from the thickeners. Overflow solution from each thickener, consisting mainly of zinc sulphate with a fine suspension of zinc-bearing solids, joins a common overflow launder for delivery to the next section.

Purification process' first step is the precipitation of iron. A concurrent step to this precipitation is the removal from solution of some arsenic, antimony, silica and aluminum.

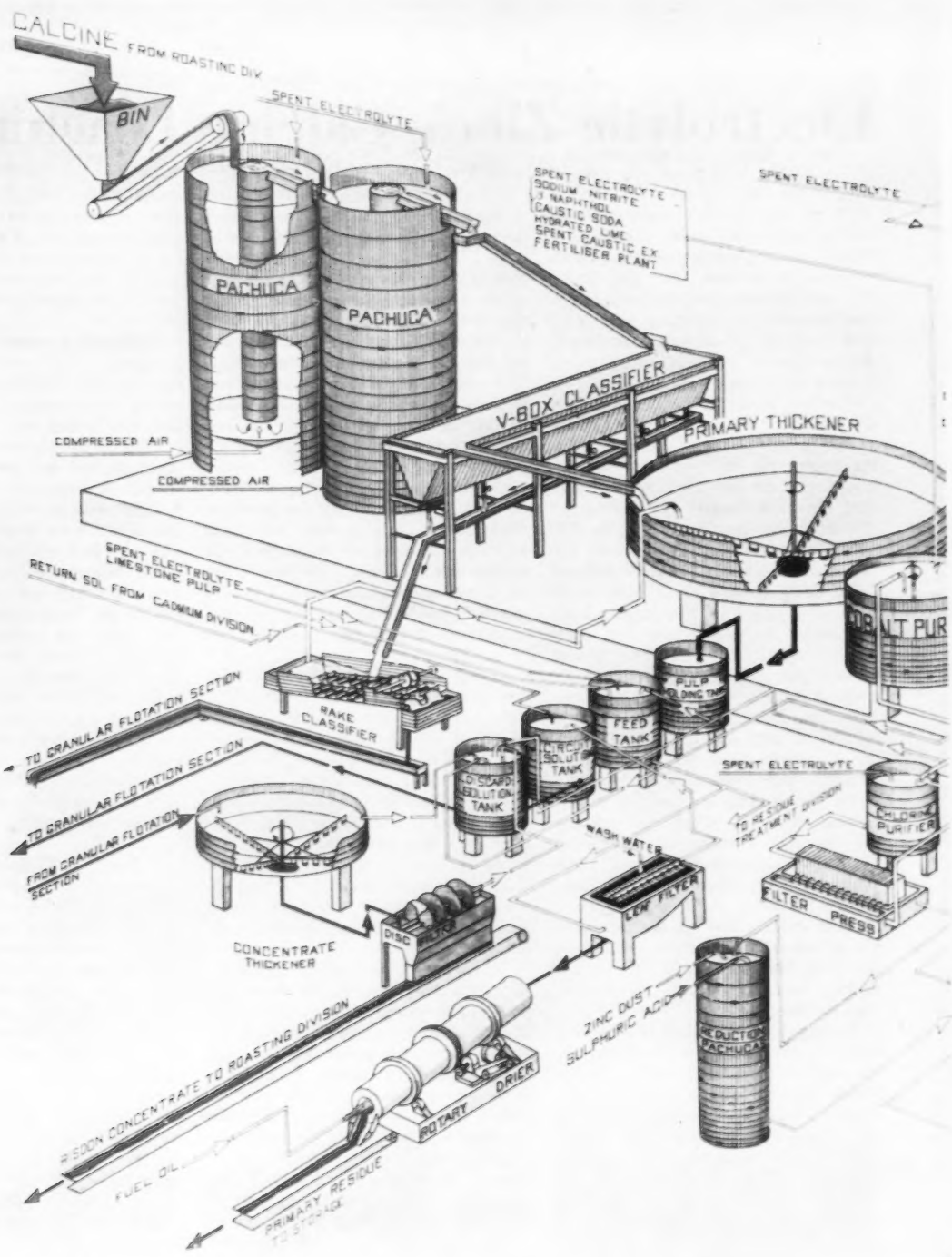
First of all, the oxidation of iron is accomplished by ground manganese dioxide (Electrolytic Division) and air in acid solution. This is followed by the actual iron precipitation by the use of finely-divided calcine: zinc oxide being the active constituent. These reactions are carried out in five 46,000-gal tanks connected in series. The tanks are mechanically and air agitated to assist the reactions. Acidity of the solution is carefully controlled to insure maximum precipitation and a good filtering pulp.

Before further operations, it's necessary to remove precipitated iron and to insure that the removed precipitate contains the minimum amount of zinc before being discharged from the Division.

Vacuum leaf filters (cotton cloth supported on stainless steel tubular frames) do the separating. Initial separation is in filter baskets having 55 leaves. Residue contains some extractable zinc and is subjected to two successive acid treatments, each followed by filtering and washing. The washings are eventually returned to the main circuit and precipitate is discharged to waste.

All filtering is carried out in the one area, and filters plus filtering vats are arranged so that they are controlled by two 25-ton cranes operating from the same travelway.

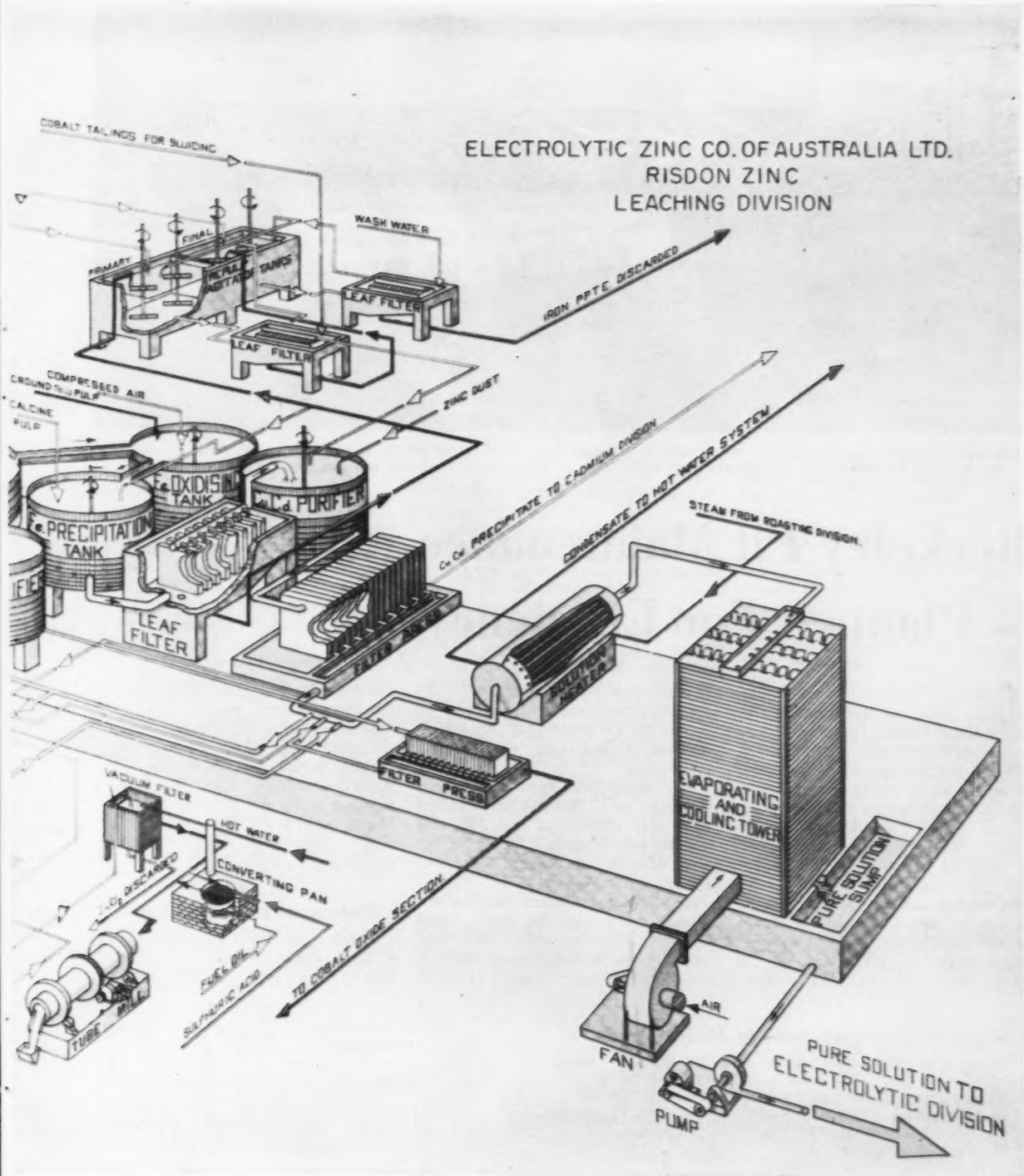
Zinc sulphate purification. Before the clear impure solution is accepted for electrolysis, concentration of copper, cadmium, silver, cobalt and chlorine is reduced in this section by batch purification processes. Precipitation of copper, cadmium and silver is brought about by agitating the impure solution with finely divided zinc dust (from Zinc Products Division) in 13,000 gal capacity tanks. The pulp from each tank is pressure fed to plate and frame filter presses. Copper-



cadmium collected on the press cloths is removed manually and transferred to the Cadmium Division for recovery of major metal values.

Because cobalt content of the pure solution need only be kept below a certain level, it's necessary to remove this metal from approximately half of the solution obtained after copper-cadmium purification. This is done by the use of an organic reagent (betanaphtol) in combination with sodium nitrite under carefully controlled acid conditions. Red cobalt precipitate is filtered off in plate and frame presses, and is recovered for the preparation of cobalt oxide in the Cobalt Oxide Plant.

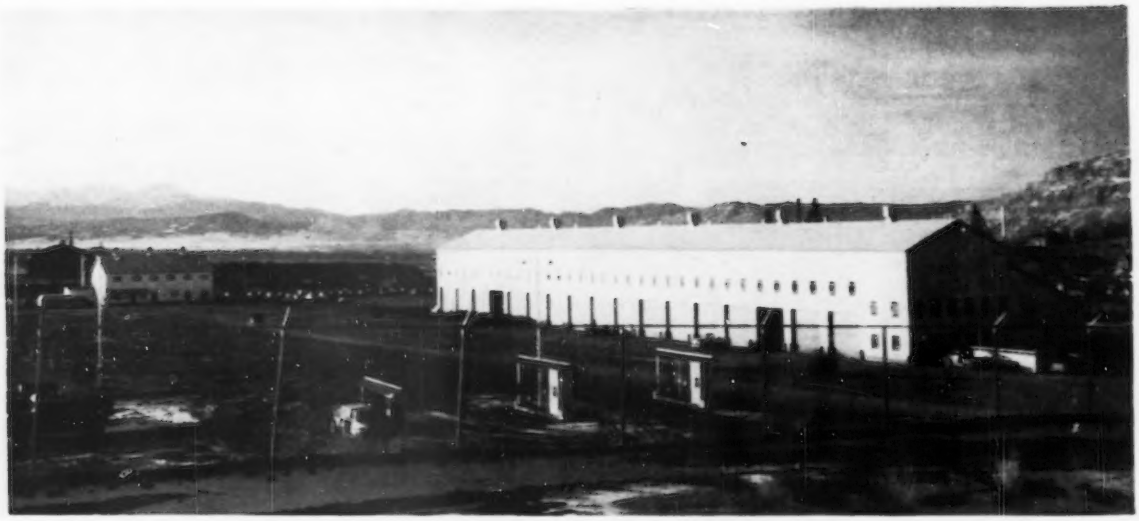
Solution's chlorine content must also be controlled by precipitating the chlorine as silver chloride by adding silver sulphate. About one-tenth of the solution is so treated and the silver itself is reclaimed for further use.



Cooling the pure solution. All solution from the three purification stages is collected together and pumped through a solution heater and then over an evaporating tower.

The solution heater is really a tubular exchanger in which the heat from some of the steam from the Roasting Division waste heat boilers is given up to the solution. The hot solution then passes down an updraft cooling tower packed with wooden slats and up which there is blown cooling air.

These combined operations are geared to cool the solution to a temperature acceptable for electrolysis and also to reduce its volume as much as possible to enable the maximum quantity of fresh water to be used for washing the Division's precipitates. Purified and cooled solution is then pumped to the Electrolytic Division.



GARAGE dominates over-all view of maintenance installation for the Berkeley Pit operation of Anaconda Co. at Butte, Mont. Pit itself, from which 17,500 tpd are produced, is in right background. Pit office and dry for operating crews is at left.

Berkeley Pit Maintenance Area Is Planned For Efficiency

PURPOSEFUL, EFFECTIVE and skilful original design is apparent in the maintenance installation now serving Anaconda's Berkeley pit in Butte, Mont. Since, by authorizing the capital outlay for its establishment, management acknowledged the importance of the facility in the maintenance picture, the engineering department, in turn, in its effort to design the best permanent shop possible, carefully studied and considered the many factors on which the design of the of the ideal shop should be based. These include: (1) size and type of pit equipment fleet to be maintained; (2) schedule of pit operations; (3) climatic conditions; (4) nearness of site to pit; (5) nearness of equipment distributors and ease of obtaining spare parts.

Ore production from the pit is scheduled at 17,500 tpd and reserves total over 100-million tons. Blasting practice and crushing-shipping facility were described in *E&MJ*, December 1957.

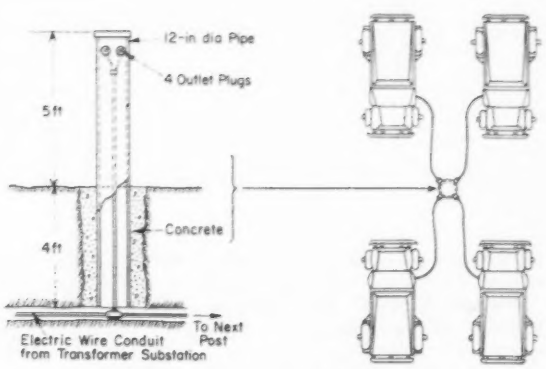
The new maintenance facilities are situated on a large flat area a short distance from the eastern rim of the Berkeley pit. A short branch road off the main highway affords access to the fenced-in site and a branchline of Northern Pacific passes along the western boundary of the site. Layout includes: main shop building with various repair rooms, service bays, sanitary facilities, and shop office; separate wash and paint shop; warehouse; general pit office; fuel storage and dispensing facilities; and equipment park.

Parking and Fuel Facilities

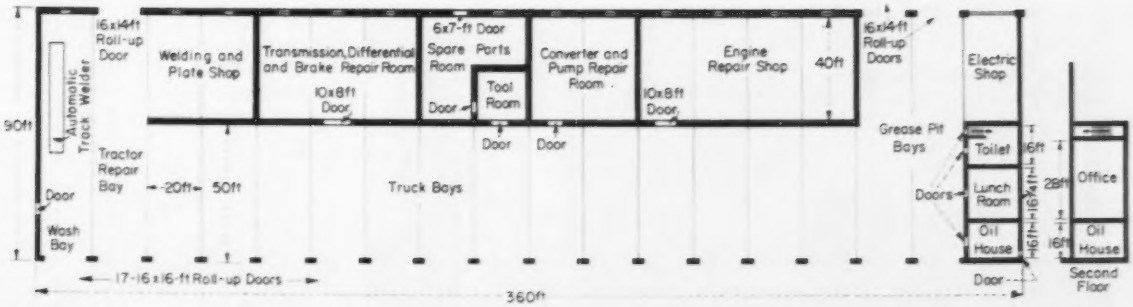
Around the main shop building is a large area for parking crippled machines, as well as those already

Big List Of Equipment Is Maintained

4 Rotary drills (3 B-E 40-R crawler, 1 Joy 225 truck)
6 Dipper shovels (5 B-E 150-B 6-yd, 1 B-E 71-B 3-yd)
45 Rear-dump trucks (25 Euclid 4FFD, 18 Mack LRVSW, 34-ton; 2 Koehring Dumpster 6-yd)
9 Crawler tractors (4 I-H TD, 1 Cat D-8, 4 Cat D-6)
2 Road graders (A-C 45)
2 Sprinkler trucks (Mack 4,000-gal)
1 Mobile crane (P&H 25-ton)
1 Flatbed trailer (Peerless 100-ton with Mack tractor)
1 Fuel truck (GMC 4,000-gal)
1 Lubrication truck (GMC)
1 Mechanical repair truck (GMC)
1 Powder truck
6 Pickup trucks (½-ton)
1 Panel truck
4 Jeeps
2 Passenger buses (Chev.)
2 Fork-lift trucks (Hyster No. 60)
6 Movable lighting plants (Kohler 5-kv)



HEATING TRUCKS for easier starting in severe winter is facilitated by having electrical outlets on posts in parking area.



FLOOR PLAN of main building is divided into bays for inspection, dismantling and re-assembly plus greasing; and into rooms for sub-assembly repair and other work, and supply. Shop office, lunchroom and toilet facilities are at one end.

serviced and repaired. This extra space permits doing much of the preliminary rough work on the equipment outdoors during the good season and prevents blocking access to shops by idle rigs so often experienced when no adequate parking area is available.

An outdoor electric power supply system furnishes current to heaters in parked trucks during the winter months. During this season temperatures may drop as low as minus 40 deg F and starting of motors is usually a time-consuming task. The installation consists of nine 5-ft high posts, each equipped with four electric outlet plugs, that can furnish electric current to 36 trucks. Posts are 12-in. dia pipe, capped and 9 ft long with 4 ft set below ground in concrete. Power is taken from the main line serving the shop area and stepped down to desired voltage by three transformers preparatory to entering the circuits running through underground conduits to the posts. Heaters used in the parked trucks are 2500-w units (two per truck).

Fuel is stored some distance from buildings and facility consists of four 20,000 gal steel tanks above ground for diesel oil and two 10,000 gal underground tanks for gasoline plus pump house and loading dock and three fueling points. Fueling points, two for diesel and one for gasoline, each have three nozzles so three pieces of equipment may be handled simultaneously at each.

Main Shop Building

The main shop building housing the service bays, repair rooms, and office is designed to handle everything from periodic inspection to major overhaul. It is a steel frame structure 90x360 ft, resting on concrete foundations and covered on the exterior with 24-gage Steelbestos corrugated sheeting. The roof is a 2-in. T&G CM wood deck covered with J. M. Brooks 4-ply white top roofing. All outside walls are insulated with 1½-in. O-C fiber glass sheets for a distance of 12 ft above the building floor, followed with 1-in. sheets to roof. Along the entire length of one side roll-up type doors, 16x16 ft, offer unimpeded openings to equipment entering or leaving the service bays.

Adequate lighting is provided by a network of ceiling lights supplemented by natural light from windows and doors. No expense has been spared in providing proper ventilation in assembly areas and sub-assembly shops. The roof of the building is equipped with six 36-in. gravity ventilators, and inside the building is available a mechanical exhaust gas system to prevent accumulation of fumes and gases while motors on trucks or tractors are running, or while motors are being tested after overhaul, and during heavy welding. The installation comprises three 15-hp American Blower fans, appropriate flexhoses, ducts, and suction lines to grease pits.

Eight National Champion Model DD-125 circulating air space-heaters using natural gas furnish heat during the winter months. Fire protection is provided by an elaborate sprinkler system operating inside the building. All shop areas have abundant electric and compressed air outlets.

General Bay Area

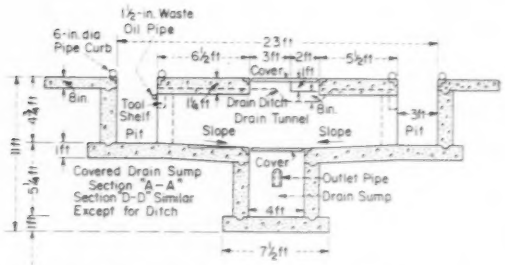
Half of the building floor area is devoted to inspection, dismantling and reassembly of trucks and tractors. This area runs almost the full length of the building and consists of 13 bays each 20 ft wide, 50 ft deep and 30 ft high from floor to lower cord of roof truss, providing sufficient space so that equipment being worked on does not crowd columns or roof structures. A 20-ton overhead bridge crane is available to facilitate lifting of heavy parts.

At one end of the area is a tractor repair bay and a wash bay; at the other, two grease pit bays. Grease pits can handle four trucks at a time. Both tractor bay and grease pit bays

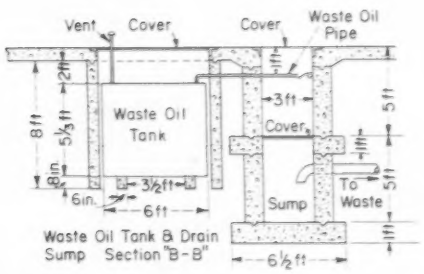
MAIN BAY AREA has easy access through 16x16-ft. roll-up doors, uncluttered working space, crane, handy tools along wall and good light and heated ventilation.

Grease Pits Are Designed For Fast Lubrication

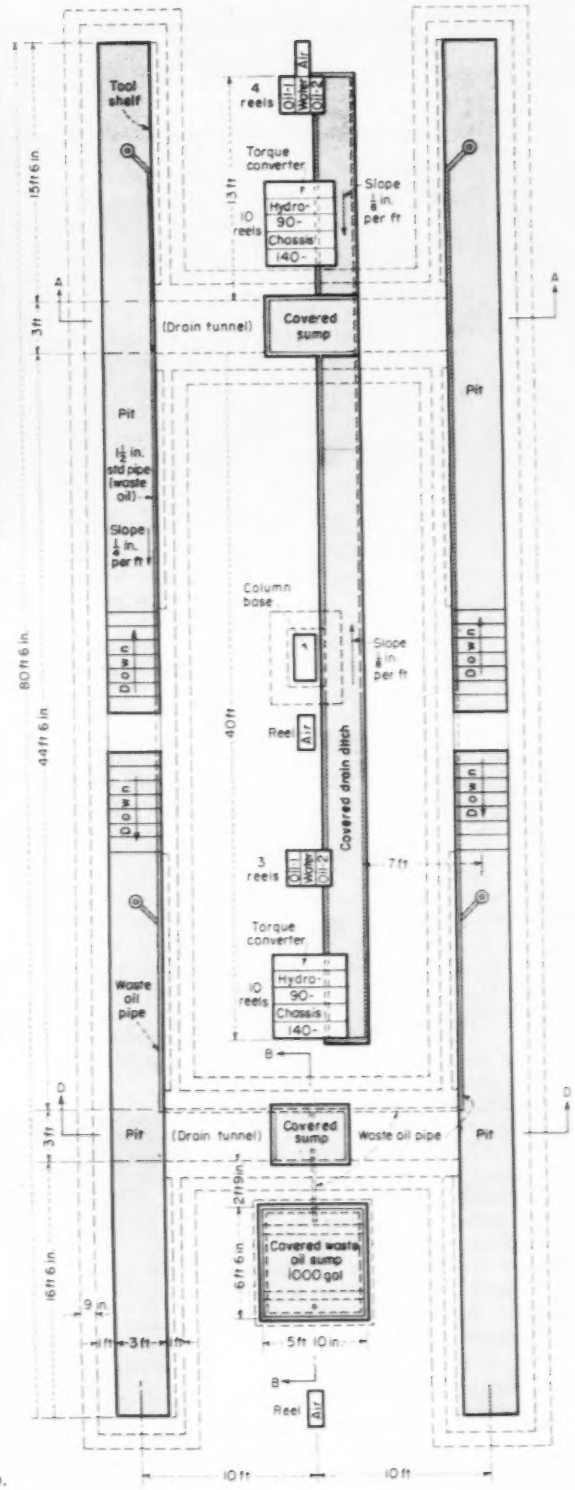
LUBRICATION MATERIALS as well as air and water are fed to vehicles through hoses mounted on centrally located reels. Four trucks can be serviced at one time and doors at both ends eliminate bottlenecks in moving trucks on and off pits. Recessed shelf in pits is handy for tools and lights.



DRAINAGE from pits and ditch is through tunnels to sumps.



WASTE OIL is caught in drains which lead to central sump.



have main doors at both ends to reduce time-consuming backing out. Lubrication materials used here are centrally fed through hoses on reels to avoid cluttering up floor area. Air and electric lines available here and in other shop departments are also mounted on reels. Shop floors are swept clean periodically with a mechanical cleaner.

Equipment installed at strategic points along the interior wall facing bays includes 3x10-ft steel work benches with vises to handle small parts, floor stand grinders, and others.

Special tools such as jacks, portable hydraulic presses, hand grinders and drills etc. used in the course of truck or tractor repairs can be obtained with minimum loss of time from a centrally located tool room.

Sub-Assembly Shops

Sub-assembly repair rooms occupy the other half of the main shop floor adjacent to main bay area. Over-all dimensions of this section are 40x260 ft. Shops installed here include a welding and plate room; transmission, differential, and brake repair room; central spare parts room; tool room; converter and pump repair room and engine repair room. All are well lighted and ventilated, and lifting facilities include a 2-ton monorail crane.

An electric shop containing special testing equipment such as distributor synchronizers, armature tester, spark plug tester, and others is alongside the grease pit bays at the end of the main shop building. Here are also the lunch room, office, sanitary facilities and oil house.

Welding shop area, equipped for routine welding and complete rebuilding jobs, is about 40 ft wide and 40 ft long with one side open to the tractor repair bay. It is walled off from the other shop rooms and truck bays to minimize hazard from arc flash and fire. Fume control consists of an exhaust fan installation using flexhose with intake hoods to facilitate proper positioning. Conventional equipment installed consists of two steel work benches, lockers, rod storage, ½-hp Wells metal band saw, layout table, 15-hp Daco abrasive saw, and 2-hp grinder. In addition, in an area across the tractor repair bay, are a 40x4½-ft Rexarc automatic track welder, welding positioner, and S. A. 750 welder, 440 v and 64 amp. Other welding units include portable oxy-acetylene cutting and welding machines and setups for heavy application of build-up material to shovel buckets, tractor crawler parts, and others.

Transmission, differential, and brake repair room, adjoining the welding shop, is the second largest sub-assembly shop, measuring 60x40 ft. Here, too, are available the latest tools and test units to carry out all transmission, differential, and brake work needed. These consist of a 100-ton press; 26x84½-in brake drum lathe; I-R air compressor; brake riveter; cabinets for storing transmissions; two ½-hp, 110-v Kleer-Flo parts cleaner units; 2-hp floor stand grinder; wheeled differential stands; three 3x10-ft steel work benches for mechanical jobs and one 3x10-ft steel work bench for electrical work; and a drinking fountain.

SUB-ASSEMBLY REPAIR areas are typified by engine repair room. At right, wheeled dolly fabricated from pipe holds engine and makes handling very simple.

In converter and pump repair room, converter and pump units are overhauled and rebuilt. The room is 40 ft wide and 40 ft long and contains: three 3x10-ft steel work benches; fuel pump test stand; 6x6-ft steel table for converters; two 36x24-in., ½-hp, Kleer-Flo parts cleaning units; 2hp grinder; 4-hp, 440-v electric servicer (truck generator tester); drinking fountain; and wheeled "dollies" for easy handling of assemblies. All apparatus is easily accessible and there is ample room between it for the mechanic to maneuver the machine part under repair or test.

Engine repair room is the largest of the sub-assembly shops. The room is 80 ft long and 40 ft wide. It is equipped with the latest tools and testing equipment to carry out complete engine overhaul and rebuilding jobs. Major equipment units available include: four steel work benches; four 3x8-ft wheeled engine stands; LeBlond 16-in. sliding bed gap lathe; Lampco surface grinder; Model B engine stand and dynamometer; Kwick Way valve facer; 2-hp floor stand grinder; 28-in. drill press; honing machine; two ½ hp, 110-v Kleer Flo units; tool cabinet; and drinking fountain. Supplementary tools and engine parts are obtained quickly from the nearby tool and spare parts room. All heavy lifting is done with a 2-ton monorail crane.

Tool and Parts Room

Spare parts and tool room covers a floor area 40 ft wide and 40 ft long. The parts section is well stocked and efficiently organized. A special card system keeps track of the number and location of each of the many items stored, and frequent checking on the part of the man in charge and consultation with the office minimizes under or overstocking of any item. Small parts are stored in neat metal racks and bins, and large units in places of easy access by vehicles and lifting facilities. Special small tools kept in the tool room are arranged efficiently on wall boards, and large tools are stored near the counter within easy reach of the repair men and mechanics. Each tool is kept in a specific place when not in use. Check is by brass badge carrying mechanic's own code number. Every tool is accounted for.

Other Buildings

Washing, degreasing of equipment and paint work are done in a separate building situated a short distance from the office end of the main shop building. The floor area of this building roughly measures 72x92 ft, and is divided into wash and paint shops and two concrete aprons for handling large equipment units. A Malsbary steam cleaning machine is available for washing trucks and tractors preparatory to inspection, servicing, and repair. In the paint shop conventional and special spray paint outfits are used for painting rebuilt or repaired truck bodies and other parts.

The general warehouse serving the shops is near the sub-assembly shops side of the main building and its floor area is 43 ft by 74 ft.

Office and change room building for pit operating personnel is a short distance from the tractor repair end of main shop and faces down the parking area in front of multiple bay doors.

MEETINGS drew capacity crowds for all sessions and subjects.

LUNCHEONS were for business as well as conversation.

AIME Offers Information-Packed Panels

RECHRISTENING the Mining, Geology and Geophysics Division as The Mining & Exploration Division of the Society of Mining Engineers of AIME (itself an infant) stirred up a few off-hand comments at the annual meeting, held last month in New York. Apparently some were born of that old bugaboo of conventions—concurrent sessions on overlapping topics. These generally expressed concern over the continued confusion of organizing equivalent major groups on both an industry or commodity basis (e.g. coal, industrial minerals) and on a functional basis (e.g. mining, beneficiation).

An informal group of mining engineering educators had a thought-provoking meeting at breakfast on Monday. They were primarily interested in that shrinking group of engineers who concern themselves with developing a prospect, operating a mine and concentrating mineral raw material. Discussion of standardization of curricula ran into the ever-growing conflict between demand for fully trained specialists in a particular field and need for managers with broad knowledge of science and socio-economics. There seemed little belief that the true humanities—literature, history and language—should be emphasized in engineering colleges but rather that secondary schools should provide such background and stimulate an interest. Need for five-year courses—broached the day before at Council of Education session—appeared popular.

The share of help which wives contribute toward success of mining men was given considerable recognition by recipients of the Mining & Exploration Division's two exclusive awards. The Robert Peele award for technical authorship by younger members went to Allen F. Agnew, now South Dakota state geologist, for his 1955 paper giving fundamentals of lead-zinc exploration geology in upper Mississippi Valley. The Daniel C. Jackling award and invitation lecture on a significant contribution to technical progress went to Abbott H. Shoemaker, general manager of Homestake Mining Co., for efficient and profitable operation under fixed product price and inflationary costs including planning for deep mining. Highlights of the lecture, which covered the latter plans, included conversion to open cut-and-fill stoping, sinking an interior shaft and a combination sinking-raising of a circular ventilation shaft. (A detailed description of practice and plans appeared in *E&MJ* May 1957).

Percussion drilling fundamentals, reviewed in a paper by H. L. Hartman, have been rather thoroughly examined by research during the past decade but a number of facets require more investigation. For instance, now indexing does not appear to have the influence attributed to it only a few years ago. Energy losses in impact across joints are very large. And there is a need for study on the mechanics of failure in brittle material—actually part of rock mechanics. A more general, brief "Survey of Potential Drilling Methods" was delivered by R. Simon at a session of the Society of Petroleum Engineers. The substantial contribution to basic drilling research which the petroleum industry has made by sponsorship of Drilling Research Inc. was apparent in both papers.

Blasting with ammonium nitrate fertilizer, a panel discussion, again was a convention drawing card. But more than a few listeners privately commented that the discussion left much to be desired as far as revealing how close the industry keeps up on published literature. It again was established (see Missouri Symposium *E&MJ* January 1958) that 1 pt of No. 2 fuel oil per 10 lb of prilled AN fertilizer poured into the hole concurrently, has proven to be an explosive which roughly equals 50% dynamite on a pound for pound basis at under half the cost. Although most suppliers indicate proper detonation requires a minimum primer of 10 lb of 40% dynamite, a comment from the floor strongly stated that Hanna Coal Co. has proven the effectiveness of using 50-grain detonating cord alone. Minimum diameter has lost, and moisture seems to be losing their critical aspects. For safety, most users feel mixed quantities should be handled as fixed high explosive, although fire is only real hazard. Handling fertilizer alone is governed by relatively simple commercial regulations. A good contribution was L. J. Patterson's description of a powder supply truck on which is mounted a hole-loading hopper fitted with an outlet funnel ringed by ducts through which proper amount of oil is metered.

Blasting in general was also briefly touched upon in an excellent public relations movie on Blasting Vibrations and in the "star's"—L. D. Leet—in-person question-and-answer period which followed. But the session once again suggested wider distribution of literature on the test-proven tension-slabbing theory of blasting (e.g. USBM Information Circular 5356—Rock Breakage By Explosives). Related theory on high speed stressing of solids was very comprehensively covered in two sessions of the Institute of Metals division of the Metallurgical Society of AIME.

Planning for haulage by truck at open pits and by conveyor in underground mines was aided by two papers—H. A. Wimeths's report on truck characteristics developed at Chino Mines and H. M. Graff-J. R. Gronseth's joint paper on conveyor criteria established

by Inland Steel Company research:

Mine Hydrology was a session sponsored by Industrial Minerals division. As one of the papers, H. E. LeGrand presented an ideally clear and concise primer. Like any well, a mine produces a dewatered cone of depression in the water table. If the cone intercepts a surface or underground source of water, pumping must increase. If it intercepts an impermeable area, it will not increase.

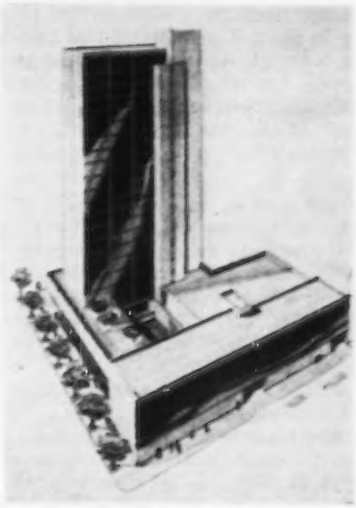
Exploration people really got down to brass tacks with a full program on detailed techniques and case histories. The geochemists contributed a good share—giving an indication of the ever growing importance of soil sampling in prospecting. The geophysicists gave ample evidence of their rising competence in the hard rock field too.

Economics of new mineral projects received excellent treatment in good basic papers at several sessions. At Monday's Mineral Economics session, J. E. Castle in a meaty paper emphasized that the key to successful evaluation is an accurate market study which must give considerable attention to competition of other producers and other commodities. At a session on geology of titanium. F. McKinley described Exploration Methods and Evaluation of Sand-Type deposits. And an MGGD session on Wednesday included: D. M. Davidson's paper on Economics of Exploration which gave much credit to aerial methods for holding down costs; J. A. Patterson's practical outline and example for Statistical Methods of Calculating and Analyzing Ore Reserves; R. E. Driscoll Jr.'s outline on legal aspects of acquiring mineral interests; M. W. Cox's discussion on the geologist's work in acquisition; and A. L. Slaughter's further details on valuation.

Direct reduction of iron ores, particularly the R-N Process, was reported in three papers. Alex Stewart, National Lead Co. and H. K. Work, New York University consultant, pointed out that the R-N Process economically produces products suitable for blast furnace, cupola, open hearth and electric furnace use. Depending on the feed mineralization, concentrate in the range of 95% total iron, 90% or better metallic iron and 2 to 3% SiO_2 are being produced with 85 to 90% total iron recovery.

Some low grade ores produce two concentrates rather than one—a high grade electric furnace feed and a lower grade blast furnace material. More than 100,000 tons of ore and concentrate have been treated at Republic Steel Corp.'s Birmingham, Ala. pilot plant.

Production cost elements are listed for cost estimate purposes. The authors also estimated capital costs for a 400,000 annual ton production plant. Such a plant would treat low-grade ore and produce two products—280,000 tons open hearth iron and 120,000 blast furnace feed. Total cost would be about $19,364,000 or $48.41 per annual ton.—*From Method For the Beneficiation of Low Grade Iron Ores Involving Direct Reduction.*



NEW CENTER will overlook United Nations Plaza, at New York's East River.

In another paper—"Recovery of Iron Ores Containing Titanium, Manganese, Chromium and Alkali Metal Sulphate"—A. G. Oppegaard, O. Moklebust and G. G. Reed, Jr., National Lead Co., stated that R-N Process can reduce iron ores containing any of these above materials to get a product containing 90 to 95% metallic iron. At the same time the process would remove 55 to 80% of the TiO_2, 75 to 95% of the MnO, 60 to 90% of the Cr_2O_3 and up to 97% of the alkali metal sulphates. Finished briquettes from the process ran 89 to 96% Fe, 1 to 5% TiO_2, 0.2 to 1% MnO, 0.3 to 1.6% Cr_2O_3 and up to 1% alkali metal sulphates. Usually only one of these components was present in any one ore under test at the Alabama pilot plant.

Third paper on direct reduction was entitled "Reduction of Adirondack Magnetite Concentrates in the R-N Process and Melting Tests on the Briquetted Product" by E. C. Smith and D. E. Babcock, Republic Steel Corp. Working on Mineville, N. Y. concentrates running 69.3% Fe, 0.06% Mn, 0.08% P, 0.14% S, 3.56% SiO_2 and 1.54% combined oxides (MgO, CaO and Al_2O_3), R-N Process turned out briquetted reduced iron that assayed 96.48% Fe, 0.05% Mn, 0.03% P, 0.54% SiO_2, 0.02% S and 1.47% combined oxides.

Total of 3,980 tons were shipped to Republic Steel's electric furnace plant in Chicago, Ill. for melting tests. While the tests were not 100% satisfactory, the melting shop crews asked for more. One major problem was the high bulk density of the reduced briquettes—225 lb per cubic ft. The authors said that size and shape of the briquettes will be modified to reduce the bulk density.

Measuring solids flow. "Gamma Ray Gages in Beneficiation Plants" by John R. Riede, Ramsey Engineering Co. Accuracy of measurement with modern gamma gages for slurries is almost phenomenal. In one application, measurement of the specific gravity of a magnetite slurry flowing through a 6-in. pipe is being made over a range of 1.10 to 1.40 specific gravity units with a precision of plus or minus 0.006 specific gravity units.

Thomas L. Mell, Trans-Weigh Co., in his "Automatic Weighing and Rationing Solids" described a load cell (see New Products Digest) for measuring flows of bulk conveyed solids with particular reference to remote control systems. Typical installations for one product and multi-product blending are discussed. Combination of strain load on the conveyor and the conveyor belt speed are used to measure, record and control feed rates in tons per hour or pounds per foot or equivalent.

Engineers have recently developed a practical method of metering a solid slurry in a hydraulic mixture that is cutting operating costs and improving efficiency, according to E. J. Klein and E. F. Nagle, Brown Instrument Div., Minneapolis-Honeywell Regulator Co. in "Hydraulic Solids Flowmetering". In the system, solids flow is determined by measuring the specific gravity and the flow rate. Specific gravity is measured by a variation of the bubbler system.

Solvent extraction and ion exchange. Dow Chemical Co.'s D. A. Ellis, R. S. Long and J. E. Magner discussed new techniques briefly, particularly for uranium recovery. Direct solvent leaching of ore, thick slurry leaching and extraction, preparation of UF_4 from leach liquor and solvent recovery of vanadium were covered.

The authors discussed Dow's proposal to produce UF_4 at existing mills by adding a second solvent extraction circuit to either an ion exchange or solvent circuit. In the process, uranium is stripped from the ion exchangers or the solvent with HCl, then re-extracted in amine solvent. The uranium is then water stripped from the amine and precipitated with HF as green

salt—UF_4. Reliable sources say that Dow has proposed such a process to the AEC. At least two of the mill proposals under consideration or advanced to the AEC call for green salt production.

Climax Uranium Co.'s research on solvent recovery of vanadium from uranium barren leach liquor was reported by R. E. Musgrove, E. E. Maurer and R. E. Fischer. Process, complete flowsheets and costs are reported. Two solvents were used—di-alkyl phosphate and an amine, both of which have some drawbacks and problems yet to be solved.

Pilot plant studies of solvent extraction that led to the design of Eldorado Mining & Refining Ltd.'s Port Radium solvent recovery proposal were presented by M. E. Grimes. Amines were used and the uranium precipitated by magnesia.

Two mill flowsheets were discussed. John D. Bryce, director and consulting engineer, and John M. Thompson, manager, described Bicroft Uranium Mines, Ltd. mine and mill program. Operating costs on the ion exchange system were covered and Bicroft's success with pebble milling was explained.

Second mill described was the resin-in-pulp operation at Mines Development, Edgemont, S. D., by G. F. Richards, H. D. Webb and George T. Bator. Over-all efficiency of the RIP section never gets below 99.5% and the average operating cost of the section is about $3.09 a ton mill feed.

Operating filters in uranium mills. Perhaps the most detailed paper read at the meeting was that describing problems and solutions to uranium filtration by C. F. Cornell, R. C. Emmett and D. A. Dahlstrom, Eimco Corp. Their excellent and thorough paper discussed all the problems—filtration of unleached ore after grinding, recovery of acid from leached pulp, pregnant liquor-leached solids separations, clarification of pregnant liquor, and the dewatering and purification of uranium precipitate.

Whole program was designed to insure maximum uranium recovery, to yield dependable operating control under diverse conditions of pH, temperature and abrasive solids, and to guarantee that the final product will meet the exacting specifications established for chloride content of yellow cake.

Improved zinc condensation. According to H. K. Najarian, St. Joseph Lead Co., the condensers on all of St. Joe's electrothermic zinc smelter furnaces were improved greatly by a rather ingenious alteration. An outside well was attached to the condenser with a pipe leading from the condenser into the top of the well and another pipe feeding back into the bottom of the condenser. Lower pipe also has a discharge outlet so that zinc could be removed from the furnace.

Upward flow of the gas and fume within the condenser caused the molten zinc to rise and flow out of the condenser as long as the furnace was producing fume and CO gases. Molten zinc that overflowed into the outside well was cooled by convection and either returned to the condenser to condense more zinc or tapped out for casting. Also the system makes it possible to make zinc alloys right in the condenser.

Modifications are covered by patent. Latest condensers hold some 40 tons of molten metal at any time with 15 tons per minute circulating through the condenser and the well. With this unit, St. Joe has condensed zinc at the rate of 70 tpd without trouble—as against less than 25 tpd before the research program began on the 96-in. bore electric furnace.

Other papers in the important field of metallurgy were Removal of Magnesia and Lime from Dolomitic Lime Type Zinc Concentrates at Bunker Hill Co., Recovery of Cadmium at Great Falls Anaconda plant. High Temperature Chlorination of TiO_2 minerals, Suspended Basic Roof Refractory Case Histories (2), for wire bar refining furnaces and anode furnaces, Sherritt Gordon's Cobalt Process, Chlorination of Metal Oxides by Calcium Chloride, the PbO-PbS Roast Reaction, Flash Smelting of Copper Concentrate, Oroya Bismuth Recovery, and the Improved Weaton-Najarian Vacuum Condenser For Zinc Retorting at St. Joseph Lead Co.

A vigorous fund-raising campaign is under way to raise $8-million to finance a new United Engineering Center to be constructed on the United Nations Plaza of New York City. Total cost of the proposed 20-story building will be $10-million, but approximately $2-million will be available from present resources of United Engineering Trustees, Inc. and proceeds from the sale of the existing building and site. The new center will replace the outmoded headquarters of UET at 29 West 39th St. which were constructed more than 50 years ago.

Of the $8-million to be raised, business and industry will be asked to provide $5-million; the balance will come from individual society members. Individual members will be asked to pledge sums, varying with salary, to cover a three-year period.

"Reach ahead with lead" is the slogan now spurring an all-out research, market-development and sales effort sponsored by major lead producers, according to R. L. Ziegfeld, secretary-treasurer of Lead Industries Association. He said that the largest and most diversified program of research and promotion has been approved for 1958, with plans being laid for even more far-flung activities in the future.

"To avoid wasting ammunition on efforts that may prove fruitless," he reported that Battelle Memorial Institute had recently completed a six months study to evaluate the research needs of the lead industry.

New or expanding market outlets for lead cited by Ziegfeld included the following: lead products for the building industry; renewed interest in red lead and other lead products in the ship-building industry; growing applications of lead in glass, glazes, porcelain enamels for aluminum, steel and other materials; a new continuous process to make lead cable sheathing, thus strengthening lead's position in this 100,000-ton-a-year market; applications in the fast-growing chemical construction industry; and the use of lead in the atomic energy field as a compact shielding material.

Chrome ore outlook. By 1970, Free World peacetime demand for chrome ore for all uses could grow to 5-million tons, or approximately double the 2.4-million tons estimated to have been consumed in 1955, according to Dr. John M. Warde, mineral economist for Union Carbide Ore Co.

He predicated this estimate on: (1) an anticipated rise in stainless steel and chrome alloy consumption, (2) on expanding requirements for refractories containing chrome to meet the growing needs of the steel industry, and (3) anticipated increase in the consumption of chrome chemicals. Since chrome ore consumption in Free World countries other than the U.S. has been significantly lower than in the U.S., he predicted that the demand over the 1955-70 period is expected to grow much faster than the U.S. rate.

No boron boom. In a paper "Boron—Its Past, Present, and Future," by D. S. Dinsmoor and F. J. Weishaupl, of American Potash & Chemical Corp., the authors urged caution in appraising the so-called potential "boron boom." The paper summarized the situation as follows, "The high-energy fuel program has in recent months created considerable public interest in boron compounds. It can be discussed only in the most limited way because of security considerations. It has been

officially disclosed that the high-energy fuels so far developed under this program are compounds containing boron, hydrogen and carbon. It must be kept in mind that much of what has been published with respect to such fuel, its cost, the ultimate requirements, etc. is purely speculative.

Authors of the boron paper advised prospectors who search for boron deposits to cover their claims with both lode-claim and placer-claim location notices, as well as prospecting permit under the Mineral Leasing Act. Sodium borates are subject to provisions of the Mineral Leasing Act, while calcium borates are subject to the provisions of the Lode and Placer Mining Regulations.

At the educators' breakfast, guest SME President-elect S.D. Michaelson expressed an industry view that EM's are losing popularity in industry because they do not meet the competition of other encroaching groups (e.g., industrial engineers, accountants) in job flexibility. This he felt came from a lack of ability in communicating (i.e., organizing and expressing thoughts), in management technique and knowledge of principles, in business technique and knowledge of economic principles, and in professional attitude (which he contrasted to a tradesman attitude). In discussing this, one thing suggested by Dr. H. L. Hartman, head of Penn State's mining dept., was recognition of a common complaint that the mining industry's failure to test the capabilities of new mining graduates makes a professional attitude difficult to retain, and subsequent employment conditions do not encourage broadening knowledge.

"Problems of Mechanization in Primitive Areas" by J. V. Thompson presented an open pit mining session with a real puzzler. It was based on a consulting job, aimed at boosting output and cutting costs at a limestone quarry in India. Although engineering problems of any kind invariably involve compromise, in this case the added socio-eco-political considerations that were imposed nearly prevented any solution. Aside from the value of its case history specifics, the over-all picture gives some insight of how bright must be the false lure of quick accomplishment which other degenerate, inhuman political systems claim to offer to countries which yearn for rapid industrialization.

The Bump Symposium of the Coal Division was apparently the only other exposition of views on rock mechanics aside from L. Obert's observations on

Man in the News—

Articulate New President for the AIME

There is a story that Gus Kinzel tells about a family trip to Madrid when he was a youngster. His mother made the acquaintance of an Argentine lady of distinction who was staying at the same hotel as the Kinzels. The ladies became friends despite a language barrier—Mrs. Kinzel found German handiest of the languages she knew and her friend understood a little of it herself. After one enjoyable afternoon of touring the Madrid shops, marred only by the difficulty of communicating certain ideas and wants, the two women returned to the hotel.

Just as they were parting, Mrs. Kinzel noticed a picture postcard in the woman's possession from Ithaca, N. Y. Within minutes each learned that they had mutual acquaintances at Cornell University and that the Argentinian herself was of American birth, had graduated from Cornell and had at one time lived in the house that subsequently became the summer home of the Kinzels at Queechy Lake, Mass.

Although Dr. Augustus B. Kinzel, new president if AIME and a vice president of Union Carbide Corp., has never said so, the Madrid episode may have had a marked effect on his attitude toward communications.

In his role as one of the nation's top research chiefs, an executive of UCC, consultant to the AEC in metallurgy, technical society officer and successful inventor, Kinzel has been called upon to deliver addresses in German in Switzerland and Germany, in French in France and Belgium, and in English abroad and in the U. S., and even in Russian at Moscow.

A man of firm convictions, Gus Kinzel uses a communicating talent to express them clearly.

After his acceptance-day luncheon, Kinzel in an interview called for an increased quality of engineers over a mere increase in quantity. He called for special schools for really bright students to take advantage of their ability and avoid their loss through boredom with the slower pace of the regular school. Even the most sensitive of educators must accept the Kinsel thoughts when he knows that they are based upon a bachelor of arts degree in mathematics, cum laude, an engineering degree from MIT and a doctorate in science and engineering from the University of Nancy in France.

In another interview, his good humor combined with articulate delivery to lay forever the glamorous ghost of one of the industry's most adored and reviled "wonder metals". Dr. Kinzel noted that, "Several years ago during the first flush of enthusiasm over its properties, titanium was dubbed the 'Cinderella metal'." He added, "It still is—only the time is ten past midnight. Cinderella has left the ball after her spectacular debut. She's wretched again—and it may take a few years for the prince to catch up with her."

". . . a Renaissance man."

Of late, titanium's friends have been nearly as sensitive as the members of the academic fraternity, but once again the speaker had a strong basis for his statements. He was one of the leaders in development of the sodium reduction process for titanium manufacture.

The same background that enforces an opinion of titanium today also gives the basis for a faith in titanium's future. For Gus Kinzel made it clear to titanium's supporters and critics that he feels the metal has a real potential, and in the not-too-distant future.

The Kinzel accomplishments do not end with lecturing, education and titanium metallurgy. In the early days with UCC, Kinzel proved the value of elliptical heads for pressure vessels. His two broad fields became welding and alloy steels. As reported in the magazine *Metal Progress*, he has designed a portable testing machine, explored the nondestructive testing of welds by sonic and X-ray methods, and originated what is labeled the "Kinzel bend test". His studies of deoxidizing and alloy elements solved difficulties of steel welding. He has some 40 patents in his name.

Communication is not limited to verbal means, nor is it a one-sided affair. Dr. Kinzel is also able to "speak" through the arts. He "still takes piano lessons" (his father was a concert performer) is a designer of modern furniture, an avid reader, and a listener as well as raconteur.

He has been described by one contemporary as "a Renaissance man." Musician, inventor, lover of the arts, story-teller, speaker and possessor of an insatiable curiosity.

Mrs. Kinzel is a muralist, and has taken a crack at authorship. The couple has four daughters and one son, and one ward, who Kinzel says, "has been like a daughter to us since her school days."

Mining Research in Europe. The general opinion seems to be that rock bursts or coal bumps are ruptures of over-strained brittle-acting minerals. The load may develop from mining or from natural tectonic or gravity forces. For coal apparently 1000 ft of cover starts the problem—this would only be about 1000 psi if hydrostatic, but some evidence indicates horizontal stress may be greater. Two schemes for reducing bursts stand out. One is to prevent high stress on projecting remnants or on abutments of large overhangs by eliminating these conditions—e.g. retreating longwall caving. The other is to de-stress blocks by producing a crushed zone for some distance in from the face by large hole augering or blasting drill holes in the solid.

Dawn Uranium (*Continued from p 97*)

this tank forms the feed for the second bank of three pachucas.

Ammonia is added manually to the first and to the last by another automatic controller-recorder. Final pH is from 6.8 to 7.0, completely precipitating the uranium. Overflow from this last pachuca is thickened, heated to approximately 90 deg C, again thickened and then filtered on another 4x3-ft drum filter, equipped with a roll discharge. Filtrate reports to one of two eluate makeup tanks.

The filter cake averages 50% solids, but seems quite dry. It is dropped through a chute to an extruder which is part of the Proctor and Schwartz drier.

The Proctor and Schwartz dryer is heated by steam to 280 or 290 deg C. It is equipped with a variable speed, punched, stainless steel conveyor which transports the 3/16 in. extruded pellets slowly through the drying chamber. Blowers circulate the heated air which is sent through a water washed Rotoclone before being discharged to atmosphere. After leaving the drier, the yellow cake is conveyed by a series of screw conveyors to steel drums. Before entering the chutes leading to the drums it is forced throug a ¼-in. screen. Drums are hooded and dust loss is negligible.

Drums of concentrate are sampled, weighed, numbered and sealed. They are shipped in less than 50 drum lots to the AEC at Grand Junction, Colorado by truck.

Final concentrate grades, reported as U_3O_8, although the precipitate is ammonium diuranate, must be 75% to avoid penalty. There are also several maximum impurity percentages that cannot be exceeded without penalty.

In some parts of the plant, up-to-the-minute metallurgical information is necessary. To achieve this two small laboratories have been installed in the mill building in addition to the main laboratory which is a separate installation.

One lab is used for washing and drying of pulp samples and for the free acid and ferric iron determination of the leach circuit. The other is adjacent to the IX column automatic control panel. Colorimetric uranium determinations, as well as nitrate and acid control is handled in this laboratory for the IX circuit.

Precipitation section's pH control is automatic but is frequently checked by hand instruments. Yellow cake sample pulverizing, blending and drying is handled in a small room located in the yellow cake section of the plant.

The main control laboratory handles all daily samples. It is staffed by a chief chemist and three assistants who make about 1,000 determinations per month. Most of the daily mill control samples are run by the fluorometric procedure which has been found to be most accurate on tailings and barren solutions. All lot or head samples are run volumetrically by a standard procedure which separates interfering elements by a sulphide group precipitation and a cupferron extraction, reduction of the uranyl ion with a Jones reductor and reoxidation using ceric sulphate as the standard oxidant. This procedure is accurate on such ores to ± 0.005%.

Concentrates are similarly treated except that potassium dichromate is used as the oxidant. Accuracy of this procedure is expected to be within ± 0.30%.

There are a total of 80 men on the payroll distributed as follows:

Administrative, office and warehouse	7
Mine	10
Scale house	3
Laboratory	4
Miscellaneous	1
Mill	55

The mill crew consists of four complete shifts of six men per shift under the supervision of a shift boss. Men work 42 hours per week. The maintenance crew is composed of six mechanics, two electricians and two carpenters. These men are working 48 hrs per week under the supervision of the master mechanic.

The crushing plant is operated by two men, six or seven shifts per week. The yard crew is composed of two men. There are three sample preparation men and three men on the bull gang. This makes a total of 63 actual jobs at the plant. The other seven men are relief to fill in the work week. Assuming a normal production of 440 tpd, seven tons per man shift are being processed.

Supply and Reagent

Reagent and supply consumption is approximately as follows:

H_2SO_4 used in leach circuit	100 lb/ton
H_2SO_4 used in IX circuit	15 lb/ton
HNO_3 used in IX circuit	3.3 lb/ton
CaO as (calcium hydroxide) used in ppt.	6.5 lb/ton
Separan	0.28 lb/ton
Ammonia (anhydrous)	2.8 lb/ton
Balls	0.9 lb/ton
No. 6 fuel (Boiler fuel)	2.4 gal/ton
Power (total for whole plant)	35 kwh/ton

Some of these items are being used in greater quantities now than they will be in the future. For instance equipment is currently being installed for the recovery of nitrate.

This plant is equipped with numerous instruments. There is no doubt about the desirability of automation when present day labor costs are considered. But—the instrumentation incident to automation should be kept as simple as possible and still do the job. For instance, a simple float actuating a mercoid switch is much more trouble-free than a set of electrodes. If air controls are to be used, the operator will find it necessary to install oil filters, dessicators and a separate receiver for instrument air in the plant.

Nearly all of the controls in the plant are air operated. An installation such as the one just mentioned is currently under way. The air produced by a compressor equipped with an intercooler, aftercooler and a blow down is not sufficiently clean or dry for use on instruments.

If possible, all instruments should be purchased from one manufacturer, and last but not least there should be at least two men on the job capable of repairing instruments. They should be experts. The ordinary electrician or mechanic is not capable of handling this phase of the work.

In conclusion, I would like to express my appreciation for the kind assistance of the following people in the preparation of this presentation: R. R. Porter, consulting metallurgist, R. B. Fulton, manager-Dawn Mining Co., Paul Stucker, mill foreman, William Darlington, chief chemist.

Union Carbide's uranium mill, Uravan, Colo.

LARGE URANIUM PRODUCER picks dozens of "U.S." Belts for a dozen different uses

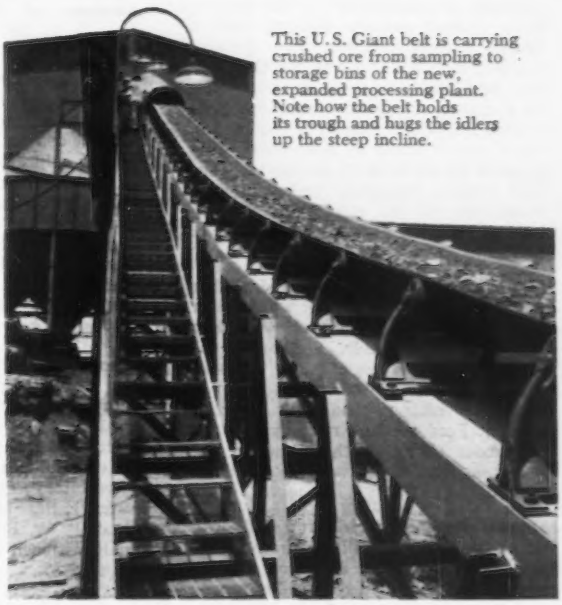
High up on the mineral-rich Colorado plateau, one of the nation's biggest uranium-processing plants is operating on a 3-shift, 7-day-a-week basis. U.S. Rubber Conveyor Belts play a vital part in its operation.

For example, last year when a large addition to the plant was completed, U.S. Rubber supplied 16 of the 18 new conveyor belts. With this addition, more than three dozen "U.S." Belts now help carry the vital tonnage through the various phases of uranium processing.

One U.S. Giant® belt handling hot materials has *outlasted previous belts four to five times.* Another U.S. Giant belt carries ore down a 25% grade to fine ore storage bin. So far it has lasted 11 years, and in all that time has required practically no maintenance.

Such performances as these are never a surprise, when U.S. Rubber's Three-Way Engineering is employed. With this exclusive service, the "U.S." engineers work right along with the engineers of the mine and the designers of the conveyor system—to make sure the belt will do *exactly* what is required.

This service—plus a complete line of belting—is available at any of our 28 District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



This U.S. Giant belt is carrying crushed ore from sampling to storage bins of the new, expanded processing plant. Note how the belt holds its trough and hugs the idlers up the steep incline.

Mechanical Goods Division

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WHAT'S NEW IN U. S. PATENTS

OLIVER S. NORTH

Exploration

Drill bit with drag tooth contour, especially useful for core drilling through hard rock. Diamonds are set in bit so as to produce drag cuts. Vibration is reduced and a more efficient operation attained. F.B. Williams Jr. No. 2,818,233.

Combination diamond-drag coring bit. Drag bit blades can be retracted only when drilling hard rock. In retracted position, drag blades are self-sharpening. This bit drills both hard and soft formations with good efficiency. H.I. Henderson. No. 2,819,043.

Mining

Method and means for orientating industrial diamonds in drill bits in hard vector directions. Hardest portions of points are presented to working face, thereby increasing efficiency and useful life of bits. Present diamond bit-making machines can be used without change. Highly skilled workers are not required to orient the diamonds. A. E. Long, assigned to U.S. Secretary of Interior. No. 2,817,885.

Process for in situ leaching and recovery of uranium and related minerals from carnotite-type ores. Leaching of the bed is moving progressively from top to bottom. Large diameter output wells and small diameter input wells are drilled in regular hexagonal pattern. Various stages of the operation are in progress simultaneously in different parts of the ore bed. Steps include initially flooding with a heated reagent solution, then pressure leaching in two stages with Na_2Co_3 solution, and finally washing in three steps. As a matter of economy, solutions from various stages are pumped to and used in other stages, either as is or after being adjusted by addition of needed reagents. This process reportedly makes possible broadening of the mined ore zone to include protores. C. W. Livingston. No. 2,818,240.

Improved drilling apparatus for either stoper or horizontal drilling where short over-all length of apparatus and relatively long feed is desirable. Feeding mechanism is of the single power cylinder type. Maximum feed of drilling motor is materially greater than that of feed cylinder. Feed pressure remains constant throughout entire length of feed. J. E. Feucht, assigned to Cleveland Rock Drill Div. No. 2,819,042.

Adaptor for joining drill rod and drill bit so that blows will be transmitted properly, yet permit drill rod to be raised and the bit and rod readily separated for reconditioning. J. E. Gilchrist. No. 2,819,880.

Boom-type drill support that can be pivoted vertically and horizontally and locked in any of a variety of positions by controls located adjacent to drill itself. Operator need not return to truck to lock the boom. G. H. Fuehrer, assigned to Thor Power Tool Co. No. 2,820,611

Means for raising and lowering pneumatic rock drilling apparatus on a wagon drill. Mechanism is extremely rugged and simple to operate, and is adapted for drilling either horizontally or vertically and at an infinite number of elevations and drilling angles. G. H. Fuehrer, assigned to Thor Power Tool Co. No. 2,820,612.

Two-way bit for drilling holes in ore is designed to facilitate withdrawal from holes drilled at any attitude. Upper side of bit clears hole ahead of bit being pulled. G. Godfrey. No. 2,821,364.

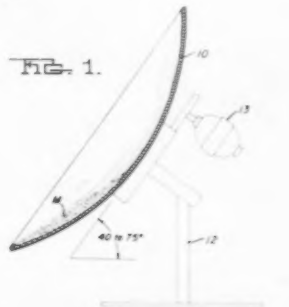
Improved diaphragm for separating anolyte for catholyte in cells used in commercial electrowinning of manganese from purified manganese sulphate-ammonium sulphate solutions. This diaphragm, made from fibers of either linear homopolymers of acrylonitril or polytetrafluorethylene, is economically and technologically superior to diaphragms made from cotton fabric or other materials conventionally used. It may be washed and re-used a number of times. R. H. Cromwell and W. A. Parsons, assigned to Foote Mineral Co. No. 2,810,684.

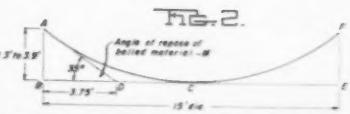
COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

Method of operating iron blast furnace so that oxygen enrichment of the air blast may be used to best advantage. Chemical composition of raw material charge is adjusted so that temperature head developed in bosh and hearth is insufficient for furnace operation using natural air blast. Heat generation with oxygen-enrichment air is increased without increasing volume of blast entering tuyeres, or appreciably increasing volume of gas leaving coke combustion zone. C. E. Agnew. No. 2,818,329.

Treatment of ilmenite, particularly MacIntyre ores, to prepare composite titanium dioxide rutile pigment. Ore is leached with HCl and digested with concentrated H_2SO_4. Resultant digestion cake is solubilized, treated with $CaSO_4$, and hydrolized to precipitate a composite hydrate. Latter is washed, dried and calcined. R. W. Brickenkamp and C. L. Schmidt, assigned to National Lead Co. No. 2,818,347.

Separation of nickel from cobalt in sulphate or chloride solutions. A sulphide of cobalt, iron or copper is added. Solution is subjected to electrolysis, with strong stirring, at room temperature. Nickel is precipitated and filtered off. Method requires no heating of solution or addition of powdered metal or alloy. M. De Merre, assigned to Societe Generale Metallurgique de Hoboken. No. 2,818,377.





Design for a disc-type balling device for agglomerating moist ore fines, for example taconite. Disc is a smoothly curved dish whose curvature is mathematically related to the angle of repose of the material being treated, permitting a greater portion of the disc surface to be utilized for pellet formation. Power requirements are reduced and capacity increased, as compared with conventional disc-type balling devices. Fig. 1 is a diagrammatic sectional view of this apparatus. Fig. 2 shows relationship of dish curvature to angle of repose of material. J. C. Agarwal, assigned to U.S. Steel Corp. No. 2,818,601.

Design for rotary dryer particularly useful for drying heavy, sticky, wet ores. Material is thoroughly dried during a single pass through this apparatus. J. M. Wolfe. No. 2,818,657.

Separation of plutonium from impurities in a neutron-irradiated uranium mass. Plutonium carrier precipitate is introduced into acidic solution containing a ceric ion. Precipitate is dissolved and plutonium oxidized to hexavalent state. Alkali metal and soluble fluoride compounds are added, and byproduct precipitate removed, leaving in solution hexavalent plutonium essentially free from radioactive fission products. J. E. Dreher and S. G. Thompson, assigned to U.S. Atomic Energy Commission. No. 2,819,143.

Separation of plutonium from uranium and fission products. Plutonium is absorbed onto diatomaceous earth and the material treated with a selective solvent, such as ammonium carbonate, to dissolve the plutonium. G. T. Seaborg and J. E. Willard, assigned to U.S. Atomic Energy Commission. No. 2,819,144.

Recovery of uranium from leached zone material overlying Florida pebble phosphate beds. R. F. McCullough and W. J. McGinnis, assigned to U.S. Atomic Energy Commission. No. 2,819,145.

Mr. North is patent consultant, Washington, D. C.

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Before you buy a Ball Mill

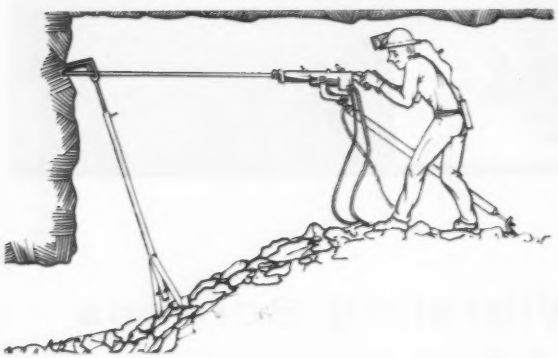
OPERATING IDEAS

Old Bits Aid Crawler Traction

PROVIDING PROPER TRACTION for shovel loaders operating on a 12-deg inclined floor has been effectively and inexpensively solved by Anaconda Co. in its Berkeley Pit at Butte, Montana. Used drill bits are welded in several rows to the track pads of an Eimco 630 overcast crawler loader.

Rounded Section Speeds Drifting

ROUNDED DRIVES rather than the rectangular ones formerly used for sub-levels made record mine production possible in 1957, according to officials of Mt. Isa Mines Ltd., Australia. In every 100 ft of development, it saved over 400 ft of drilling, 33 tons of scraping and $20 worth of powder.



Steel Holder Aids Stope Miners

SIMPLE HOLDER for airleg drill steel, suggested by Lal Boggetti, veteran miner at Mt. Isa Mines Ltd., Queensland, Australia, is used in shrink stopes to simplify collaring back holes and others that might be awkward or in a dangerous position for a man to stand.

Holder has two basic parts: 1) an extension pole with a "U"-shaped fork on one end, made entirely of 1-in. dia rod and about 6-ft long; which fits into 2) a stand with two short legs on one end, made from 1¾-in. (O.D.) pipe and also about 6-ft long. Near top, stand is tapped for set screw to permit clamping extension rod for any desired length up to 11 ft. On rod, last 7-in. of fork prongs are bent perpendicular to rod length, forming short legs which hold drill-steel saddle ("U" portion) away from rock face.

Blasting Change Ups Breakage

SMALLER HOLES, closer spacing, plus more and higher grade powder improved fragmentation at the copper pit of Pima Mining Co., 20 miles southwest of Tucson, Ariz., according to P. W. Leidich, assistant resident manager, and R. E. Thurmond, mine superintendent.

Early in 1957, stripping operations began along pit's south side for removal of a layer of dense conglomerate, 15 to 35 ft thick, lying between the alluvium and bedrock. Poor fragmentation and an increase in secondary blasting resulted when applying the drilling and blasting practice used in other parts of the pit. To overcome the difficulty, procedure for using the 44-ft primary blast holes was changed by: (1) construction of a 4-in. collar for the B-E 40-R rotary drill to permit use of a 4¾-in. Hughes Tri-Cone bit in place of the normal 9-in. unit; (2) drilling the smaller blast holes on a 6x8 ft pattern rather than the 18 to 24 ft spacing; (3) using a higher velocity 40% bag powder in place of Carbamite (ammonium nitrate powder), and (4) raising powder load per cubic yard in the hole to 1 lb from 0.5-0.8 lb, with the powder being brought well up the hole. This powder rise and the fact that a larger portion of the conglomerate was in contact with powder's explosive force resulted in excellent fragmentation and cut secondary blasting.

Before you buy a Ball Mill

— be sure you are getting ALL the advantages a DENVER MILL will give you . .

COMPARE

- **Specifications**
- **Price**
- **Performance**

Here's a challenge we make openly to any mill operator looking for mill equipment—a challenge we couldn't make if we offered anything less than the best.

It's true of *all DENVER* equipment, but let's take Ball Mills, for example. On all three counts — specifications, price, performance — DENVER has won out time after time, accounting for nearly 100 DENVER Ball Mills sold in the past 24 months.

DENVER Mill Superiority includes . . .

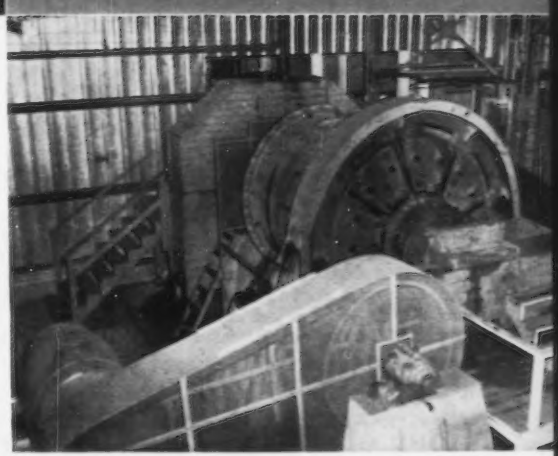
BETTER DESIGN — puts added strength where strength is needed. Length and diameter are measured inside liners thus giving greater capacity.

BETTER ENGINEERING — Head design, trunnion bearings, gears, lubrication — all are distinctive features and all reflect up-to-date engineering.

BETTER MATERIALS — Cast steel heads — you can count on the strength of steel.

BETTER TOOLS AND WORKMANSHIP — Big new machine tools, up-to-date welding and fabricating methods in our own shops mean careful, closer control.

DENVER STEEL HEAD BALL AND ROD MILLS • Typical of DENVER'S modern equipment is this submerged arc welder — assuring you the quality construction that means maximum productivity at minimum operating and maintenance cost from DENVER Ball and Rod Mills.



Before you buy your next ball mill, COMPARE! Make sure you get what DENVER can give you. Sizes to 10′ in diameter and to 20′ in length. Complete details on request. Send us information on your grinding problems.

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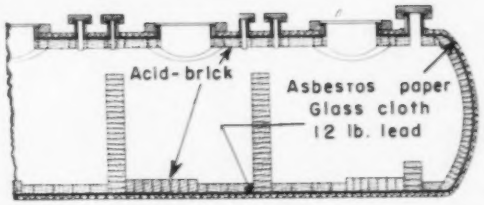
OPERATING IDEAS *(Continued)*

Lead Wall Cuts Slurry Corrosion

INSTALLATION of a lead lining, together with glass cloth and asbestos paper, has cut internal corrosion of an oxidation autoclave at Calera Mining Co.'s cobalt refinery, Garfield, Utah.

The carbon steel autoclave, a cylindrical pressure vessel 40 ft long and 6 ft in dia and operating at 600 psi in a temperature range of 400 to 450 deg F, was originally clad internally with a 10% type 316 stainless steel, coated with Epon paint, followed by glass cloth and asbestos paper (both applied with sodium silicate), and a final lining of one course of acid-brick.

After three years, the oxidized solution slurry had corroded sections of the stainless steel and had deteriorated the other material. Calera then relined the vessel as before but replaced the stainless steel with 12 lb sheet lead membrane.



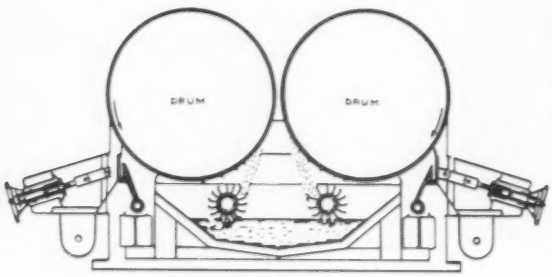
Knowing the lead and lead wool had good corrosion resistance as long as it was not subject to abrasion, splashing or washing action, the company installed the acid-brick which protects lead from abrasion or corrosion and insulates it against high or fluctuating temperatures.

Chemo-Streak-Tests Aid Mineral Identification

EASY, QUICK AND POSITIVE identification of minerals by chemical tests on streaks is often overlooked, according to K. F. G. Hosking in an article in Mining Magazine (London) September 1957. In the method, specimens are streaked on either tile, glass or metal plates and these highly reactive fresh surfaces are then treated with one or a combination of chemical reagents. In the article, detailed procedures and specific tests are described which are very similar to "spot tests."

Advantages of scheme are: non-destructive; applicable to small specimens; often fastest way to tell if given element is present; often quickly differentiates between similar minerals; simple and easily learned; and ideal for field use because apparatus and reagents are easily carried and inexpensive.

One major disadvantage is that it cannot be used if hardness is over 6 on the Mohs scale.



Drum Dryers Serve U_3O_8 Plant

COMPARATIVE SMALL SIZE and low cost for the capacity required are the principal advantages of twin drum dryers that produce the uranium ore processing plant's sodium and magnesium diuranate end product at Pronto Uranium Mines Ltd., Algoma Mills, Ont.

After weighing factors of space limitations, cost, previous applications, and production rates, Pronto selected twin drum dryers with splash feed made by Buflovak Equipment Division of Blaw-Knox Co.

Slurry to be dried is fed into a pan below drums. Into this, 2 revolving spiked rolls dip and splash it on undersides of the rotating drums. The drums, heated by 100 lb steam, evaporate water from the slurry and the powdered end product is removed by knives on opposite sides of drums.

Steam From Box Car Thaws Ore

A NEW METHOD of thawing iron ore on the ore dock pocket at Allouez during cold spells has been improved by the Great Northern R.R. In place of a locomotive, the company has equipped a box car for generating 140 lb steam pressure. The one man crew, instead of three men, drops a hose into the ore pocket and directs the steam with a long rod connected to the nozzle.

Decal Safety Signs Resist Wear

DECALS ON EQUIPMENT have replaced mimeographed rules posters at M. A. Hanna Co. The 6x9-in., long-lasting, self sticking safety sheets are applied by mechanics 24-hr before machinery is put into use. Hanna uses the following decals at all of its open pits: handling R.R. cars to and from pocket; shovel safety regulations; conveyor safety rules; truck-dumpman's signals; and churn drill safety regulations.

Hour of "Being Blind" Drives Home Employee Eye Safety Program

A PROGRAM for the encouragement of eye safety, and designed in such a way that each participant undergoes a period of simulated blindness, has been organized by E. F. Chittenden, Safety director of the General Quartermaster Depot, Columbus, Ohio.

Employees attending the eye safety session are each supplied with a kit containing such commonplace items as a toothbrush, toothpaste, shoelaces, a cigarette, and a sample page of Braille. Then, while blindfolded into total darkness, they listen to a half-hour recorded description of a blind person's daily routine; are told of the problems of selecting the correct toothbrush, finding house slippers, choosing matched shoes by feeling the laces, pouring liquids into a container, and so on. When the recording, which has been played at many leading industrial groups, is over, employees usually remain unnaturally quiet.

High dumping angle and smooth body interior sheds the load fast and clean . . . note distance of rear body chute from wheels.

Body is heavily reinforced to withstand heavy service . . . simple, rugged construction of "Eucs" keeps maintenance costs low.

More Ore on the Mesabi is Moved in "Eucs"
. . . and always has been!

Rear-Dumps of 40 and 50-ton capacities are powered by two engines providing a total of 470 to 670 h.p.—each engine drives one of the tandem axles through a separate torque converter and semi-automatic transmission.

MINNESOTA'S IRON RANGE is a tough proving ground for off-highway hauling equipment. Loaded by big shovels, trucks haul ore and rock in all kinds of weather—often on steep grades and long, difficult hauls. They've got to maintain production at low operating and maintenance cost or they don't stay on the job long.

For over 20 years Euclids have moved far more tonnage on the range than all other competitive makes. Mine operators know from years of experience that they can depend on "Eucs" for long life in heavy service—with low operating and maintenance expense. That's why Euclids are "standard" equipment on so many mine and quarry operations—with over 1300 Rear-Dump "Eucs" of 15 to 50 tons capacity working in Minnesota alone.

Have a Euclid dealer give you information on the complete line of rear-dump and bottom-dump haulers, scrapers and crawler tractors. He'll help you with your hauling problems and show you why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

BBC – Balanced Belt Construction — is BOSTON'S exclusive manufacturing method that equalizes ply stress so that each ply pulls its full share of the load . . . eliminates lazy plies.

This is the result of two advanced BOSTON processes; *Electro-Tensile Control*, which controls ply tension — and *Rotocure*, the only continuous method of vulcanization which assures uniformity throughout the belt.

New DULON Covers add further uniformity and durability to BOSTON belts. With DULON, the consistency of belt performance has been greatly increased. DULON has proven, on the job, that it is amazingly resistant to abrasion, gouging and tearing.

Let the BOSTON man present the dramatic proof about Balanced Belt Construction with DULON Covers — as it applies to your specific belt problems.

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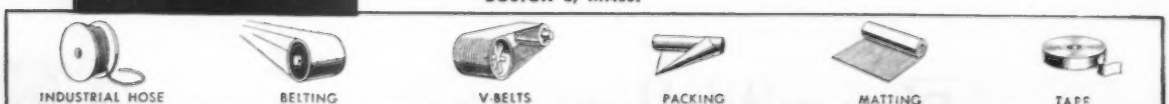

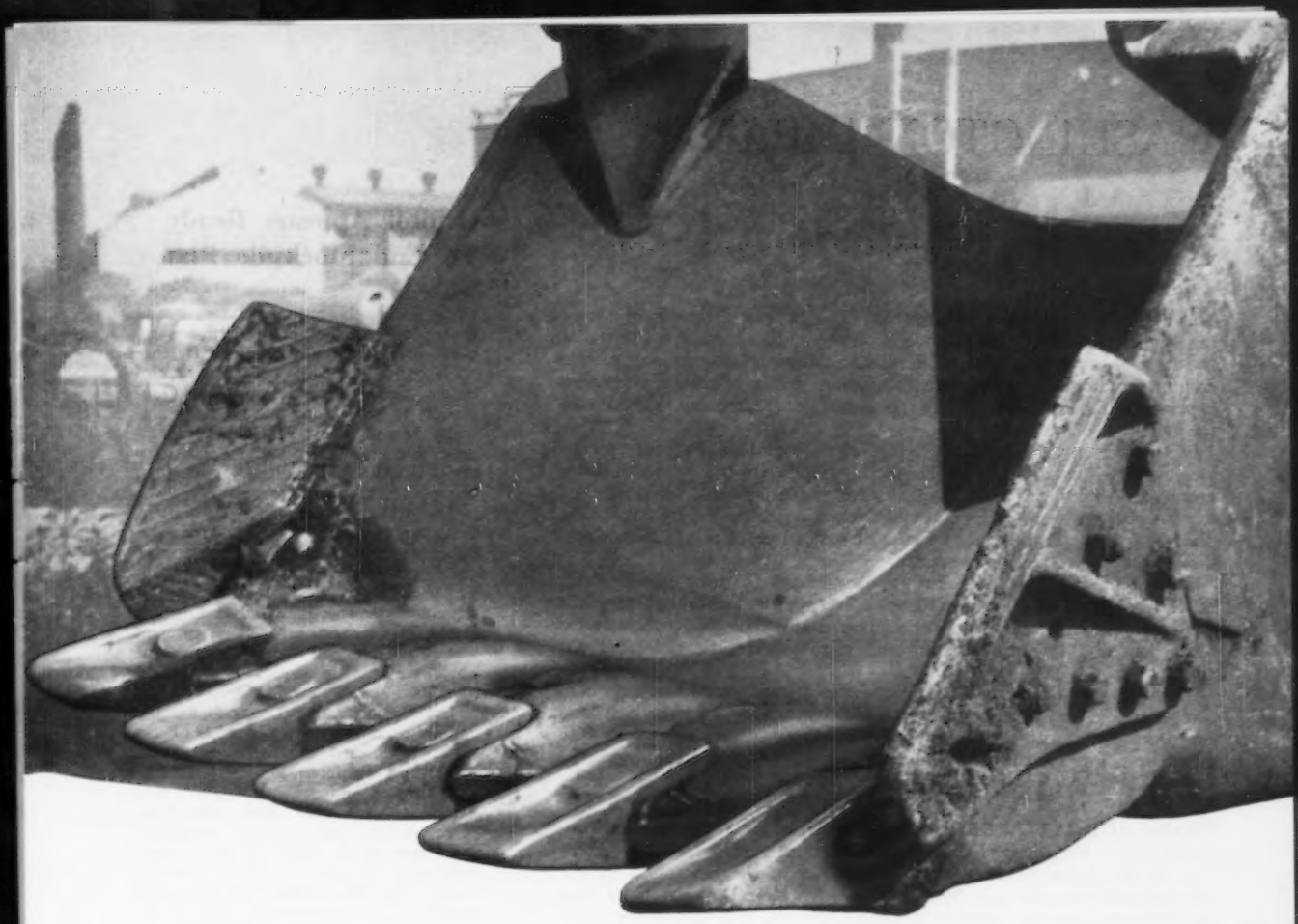

Wearpact steel teeth on this bucket last over 8 times longer!

Maybe you don't dig anything as tough as slag—but the experience of The Holmes Construction Company, Wooster, Ohio, can still point the way to savings on *any* dipper tooth application.

They were using so-called wear-resisting teeth on a backhoe bucket . . . teeth that needed replacement in 1 to 3 days. As a trial, they installed one Wearpact Steel tooth on the bucket . . . *and it outlasted competitive teeth over 8 to 1!*

An average of over 2 months' service instead of 1 to 3 days . . . does this suggest a way for you to save money?

Now is the time to find out about longer-wearing, dollar-saving Wearpact . . . the new high-hardness steel—about 500 Brinell—that's ductile and tough. Write today for complete information!

Cut your costs with WEARPACT

CAST ALLOY STEEL

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WASHINGTON IMPACT

Highlights

SEATON DOCTRINE REHASHED—The Interior Department's long-range plan for aiding domestic metals and minerals producers is back on the desks of top-level agency officials again, for what Congressional mining committees hope is a complete revamping. But privately, Government experts predict no matter what the department comes up with, it will fall far short of industry goals.

With elections closing in this year, even more than last, the Interior Department is caught between conflicting trends. On the one hand, Government stockpiling is virtually passe, and the Administration is opposed to wholesale tariff on tax relief. On the other, domestic mining's economic pinch is chafing all the more because of indications of a general business dip and increased unemployment.

Despite the department review, any new Seaton Doctrine will not differ much from the package sent to Congress last year. It will probably include new exploration, research and development aids, possibly some selected tariff boosts, a few production bonuses, maybe a little tax relief for smaller mines.

Washington officials who hold that international production and consumption controls—whether Governmental or private—are the best long range answer to soft world commodity markets say they are a long way off at best. But the push for this approach is gathering steam here and abroad.

TRADE ACT BATTLEGROUND—Meanwhile, metal and mineral producers are turning more than ever to the current controversy over extension of the Reciprocal Trade Agreements Act as the best place to win Government economic aid. Specific drives for quota protection for iron ore, lead, zinc, copper, tungsten, fluorspar, chrome, and quicksilver are in the Congressional works, with a number of others sure to follow.

But other protection-minded industries are fighting first for amendments to existing law which would reduce or remove Presidential authority to cut tariffs, and make duty boosts easier to get through administrative channels. Failing this, domestic producers of oil, textiles, chemicals, and a host of smaller items will join in a massive Congressional log-roll for quota legislation.

One dark-horse compromise worth watching is the new push for a Federal trade adjustment board to compensate domestic industries and workers who can prove injury from competing imports. This inter-agency board would be made up of present Government officials who would serve in dual capacity to mete out loans, tax relief, and direct payments to affected companies and their employees.

MINING IN THE ATOM AGE—The Atomic Energy Commission shies from a Buck Rogers tag as quick or quicker than any missile scientist. That's why it is significant to note a little item buried in the agency's recent report to Congress. Seems the AEC is studying peaceful uses of atomic energy—which it calls Project Plow-Share. A nuclear "Plowshare," AEC believes, can be used in the extractive, as well as the power industries.

An AEC commissioner expanded on this a bit the other day. What the agency is studying is whether the strip miner of tomorrow can jar loose the surface crust from undeveloped shallow mineral deposits with no less than a "clean" small hydrogen bomb.

Obviously, mining with an H-bomb is a long way off. But AEC is having the radiation labs at University of California look into the possibilities.

MODEL RESEARCH PLAN—Government mining experts are enthusiastic over the American Zinc Institute's newly announced program of expanded research activities. The trade group's goal of "consolidating and expanding existing markets and discovering new ones," is what one school of officials sees as industry's best answer to current problems of over-production and soft world markets.

Capitol Appears Ready To End Stockpile Plan

WASHINGTON'S official thinking on stockpiling is slowly becoming clearer and more definite. The recent Pettibone report—prepared by the Office of Defense Mobilization's Citizens' Advisory Committee—underscored the now official approach to stockpiling metals and minerals. The nub: except for a few strategic, lighter, atomic-type miracle minerals, U.S. stocks are already more than enough to meet any emergency.

The report made vague suggestions that the Government should have an easier way of unloading surplus supplies than getting specific Congressional approval, which it must now request. But the committee specifically advised against selling off—here or overseas—any present metal and mineral stocks, because of obvious effects on already shaky world markets.

The Pettibone report, named for the committee chairman, Holman D. Pettibone, a Chicago banker, almost went whole hog. Pettibone himself is said to have favored disposal, but he and a few like-minded members were voted down in committee. The task-force wound up recommending a shift to Government acquisition of other supplies, including medical and food items, and electrical, construction, transportation, and household equipment items. ODM followed this up with a suggested list of several hundred such items, which now must get overall agency and Congressional approval before it becomes an official shopping list. Even with approval, though, there does not appear to be anything in the list to give mine production any significant incentive.

Congress Studies Two Tax Relief Suggestions

ASIDE FROM whatever specific tax relief may be included in a new Seaton long-range minerals doctrine, there are two current drives on in Congress for general relief. One is for some form of incentive rebate for small investors, which would of course apply to small mines. This is the one tax area where Congress may accept some "reforms" this election year.

The other is for an increase in percentage depletion allowances for raw materials, being pushed by the American Mining Congress. With Congress extremely sensitive to criticism of oil depletion percentages, however, this effort is not expected to get very far.

In fact, Congressional tax committee staffers look even for a recommended reduction in a few mineral depletion allowances which were boosted above 20% several years ago. Some run as high as 23%. Most mineral depletion allowances, however, average around 15%, are not likely to be either raised or lowered.

Uneasy Unions Watch for '58 Signs and Portents

LABOR'S TOP LEADERS, at a recent series of mid-winter meetings in Miami Beach, took a long look at the remainder of 1958. They didn't like what they saw.

But, at the same time, they laid plans to make the best of what looks like a bleak future for the unions—at least short term. These plans encompassed the hard-core of union business; bargaining, legislation, jurisdiction, union rivalries and, probably the biggest topic of all —unemployment.

The conferences were headed by AFL-CIO president George Meany and included the high command of the 15-million-member federation. These are the 29 presidents of some of the biggest unions such as Walter Reuther of the United Auto Workers; George Harrison of the Railway Clerks; David J. McDonald of the United Steelworkers. Long-time independent unions like the Mine-Mill and Smelter Workers and the new independent, the recently-expelled International Brotherhood of Teamsters weren't on hand. But the decisions affected them all.

Substantially, all the plans were conditioned by one hard fact of 1958. This is a recession time, unemployment is growing, bargaining is getting tougher, strikes are going to be harder to win. With this in mind, the labor officials came to almost the same conclusion in all matters. It's time for labor to retrench, they decided. The unions would seek to hold the line where they are now—and not strike out for any bold new programs this year. Of course there'll be deviations from this, at least on the surface—like Reuther's proposed profit-sharing demand on the auto industry this spring.

Another factor causing the introspection, and inversion, by the union leadership is racketeering. The revelations of the McClellan rackets committee in the Senate has hurt labor; it has caused a public reaction that shows itself in organizing failures, political deflation, public disapproval of unions. The AFL-CIO's campaign to eliminate corruption, or kick out corrupt unions has helped to stem the anti-labor tide. But it hasn't done the whole job and the union high command thinks it's hardly time to strike out on any bold new campaign.

Here are labor's key programs and what's going to be done about them in the months ahead:

Collective bargaining. The key man in this area in 1958 is Walter Reuther; the key union is his United Auto Workers. Next month they'll begin bargaining with the major auto producers for new contracts covering more than 1-million employees. Already on the line are UAW demands for a productivity wage hike of about 10c; a profit-sharing plan that could come out to hundreds of dollars per worker each year; boosts in supplementary unemployment benefits, higher fringe benefits.

Reuther won't get all of this, by a long shot. With auto production way down, and inventories up, he'll be facing an adamant industry across the bargaining table. It's an industry which, at this point, can take a strike without getting hurt too much. In fact, it would help to get rid of the thousands of autos idling in car lots.

Reuther's bargaining was a big topic at the Miami Beach conferences. Other unions, facing similar economic troubles, will wait to see how he fares. But some, such as McDonald's United Steelworkers are assured of a hike of at least 9c in 1958 without even raising a finger. Under a long-term agreement that runs through 1959, the 1-million steelworkers collect an automatic productivity hike, plus any cost-of-living bonus that comes with rising prices. These automatic hikes have a way of putting Reuther on the spot, but at the same time helping his cause. He can't very well settle for less for his auto workers, but 1958's automatic raises at the same time provide a wage floor. He can insist on settling for no less than other key unions get.

Racketeering. The swipe that the AFL-CIO took at union racketeering last year wasn't enough to ward off union critics. Even though the federation kicked out its biggest affiliate—the International Brotherhood of Teamsters—and punished a half dozen others for permitting corruption in their ranks, there'll be a major campaign in Congress to put legislative clamps on unions. The feeling in the Eisenhower Administration and Congress is that labor leaders can't do the job by themselves—that they need some help through new legal yardsticks.

To this, some union officials would privately say, amen. Yes, they expelled the Teamsters, but that union is still going strong with the leadership that the AFL-CIO wouldn't take. Nothing has been done to change the trucking union —and Meany and Co. no longer have any authority over the Teamsters.

The White House, aware of this, has proposed a legislative package to amend Taft-Hartley; one that would put union affairs in the open.

This approach isn't favored by some officials of the AFL-CIO. They see it as one step before Government licensing of unions. They'll resist any legislative moves except one—a bill that would require public disclosure and checks on union health and welfare programs. But, because they're not in too great a position to resist such legislation, union strategists will go slow in attacking it. They're making this part of their retrenchment approach. If they don't put their heads too far above water, they figure, they can't be hit too hard by the opposition.

Unemployment. The rising number of jobless is hurting unions across the board. The United Steelworkers count more than 100,000 members out of work; the auto workers not much less. And it's hitting in construction union, rubber, glass, railroads and almost all others.

Besides bombarding the Eisenhower Administration with appeals for public works, more defense spending and the like, union leaders are hoping to force through a boost in the unemployment insurance program. Virtually all union members are covered by the Federal-state unemployment benefit system.

Prime target for fighting unemployment will be legislation; specifically, a bill called the Kennedy-McCarthy bill that would set Federal minimum standards for benefits. Under the present system, the states individually set the weekly payments (now averaging and most $30 a week) and the length of payments (about 26 weeks average). The proposed legislation would boost the payments to a minimum 50% of salary; set a maximum 39 weeks duration that the states would have to follow.

This bill won't get anywhere unless unemployment keeps climbing. By the middle of this month the clues should begin to come in on what's going to happen. If unemployment doesn't start down, the union cry will go up to make payments higher and for longer periods.

Here too, on the subject of unemployment, the unions will be arguing from a weakened position. Joblessness means fewer members, fewer dues. And, it cuts into their bargaining position. It's harder to sell a strike to members when many of them are already out of jobs.

Inter-union rivalries. This is one area the unions can do something about in 1958—and they've started to do so. From the mid-1930's and the formation of the CIO industrial unions, labor has been split over craft-industrial disputes. Even with the AFL-CIO merger last December, the argument went on. Now, they've found a solution to these fights over jobs.

The deal came at the Miami Beach conferences. Conscious of their troubles from the outside—unemployment and racketeering—they were forced in a move to self-preservation. Jurisdictional fights, especially between craft and industrial unions to do construction work in industrial plants, have been costly to unions as well as employers. They've cost jobs to both sides, as well as loss of wages. But, now, with jobs less plentiful than they've been in sometime, rival union officials decided to make up.

Another indication of labor's approach to 1958 is the Miami Beach decision by construction unions to end their costly featherbedding and make-work practices.

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How Research Shapes Our Future Prosperity

If you are looking for an industry that is going to keep on booming in 1958 and every year for the next decade, here it is. It is the industry of technological innovation through research and development.

Last year this great new industry spent over $7 billion to discover and develop new industrial products, processes and equipment. This year the preliminary McGraw-Hill survey indicates that total expenditures for industrial research and development will be even greater, perhaps as much as $8 billion. Of the companies surveyed, 57% plan to spend as much as in 1957 and 38% plan to spend more.

The sustained expansion in research and development is the best guarantee we have that the current decline in business investment in new plants and equipment will be relatively short-lived. There can be no prolonged decline in investment in an economy where technology is changing rapidly.

This editorial is designed to show how the continued surge in research and development can be expected to lead first to new products, and eventually to renewed expansion of investment in new industrial plants and equipment. Such expansion is the essence of national economic growth.

A Slow Start

The impact of research on sales and investment is still very gradual. Research spending itself has more than doubled in the last four years. But only 32% of all manufacturing firms report significant capital outlays to make new products. We are not reaping the full dividends of industrial research as yet for several reasons:

- Research expenditures were relatively small until the Korean War of 1950 brought substantial government contracts in aviation, electronic and related fields. Heavy research outlays for civilian and industrial products came even later.
- There is an average *lag*, according to research directors consulted by the McGraw-Hill Department of Economics, of roughly seven years from the start of research until the product is ready for large scale output — about five years of research and at least two years to solve production problems and develop markets.
- Complex products, such as new consumer durables and industrial machinery, have an even longer time lag.

However, new developments are certainly underway. Research began to increase in all lines of business when Korean War restrictions and

the excess profits tax came to an end in 1953. The tax revision of 1954 added a new incentive by making research outlays deductible as a current business expense. By 1955, the research boom was on.

When Is The Payoff?

With a lag of about seven years, it will be the early 1960s before these new developments become a dominant factor in capital investment. But once the flow of new products and new processes starts, it will accelerate sharply — just as research spending has accelerated in the past few years.

By 1960, over $50 billion in sales will be coming from products not on the market as recently as 1956. Sales of new products will increase year by year, but they will gain most in 1960-1962, or five years after the recent spurt in research expenditures.

Capital expenditures to manufacture new products will also rise, but with a slightly longer lag. Here the sharpest rise should come in 1962-1965, as the new products reach a volume that calls for a significant amount of new capacity. In most cases, initial output of new products will come from existing capacity.

This timing of a new wave in capital investment appears logical on other grounds. Population experts forecast an upsurge in marriages and births around 1965. So by 1962, industry will be starting to tool up for new mass markets.

The important point is this: As we approach the 1960s more and more sales and investment will be in new products growing out of research. By 1960 well over 10% of manufacturing sales will be in new products not on the market in 1956.

Meanwhile — research will help stabilize capital spending by raising the level of modernization and replacement expenditures. Of course, research does not eliminate all the ups and downs in the demand for capital goods, for there remain variations in the amount spent to expand capacity. But a high level of modernization, to cut costs and improve quality, does put a floor under any drop in investment.

What To Expect

During the next few years we can expect an increasing flow of new materials, new metallic alloys, new machinery — primarily those developments coming out of long-established research programs in the chemical and electrical industries. Industry will make wider use of specialized computers and automated equipment.

But the dramatic payoff on research comes even later. In the early 1960s the consumer goods industries will begin tooling up for their really new products — things so basically new they can change the way a family lives. Such items as plastic houses, paper apparel, turbine autos are under development right now. But it will take several years to get costs down and for population and incomes to grow to the point where mass markets are created.

When we reach that point in the mid-1960s, there will begin the greatest surge of capital investment in all history. And then — around 1965 — the new processes (full automation, atomic power, continuous steel casting) which are the slowest and most expensive part of the research chain to develop, will come into play.

The combined impact of new products and new processes, to meet an expanding market, will thus be felt in the mid-1960s — eight to ten years after the recent sharp increase in research spending. The full impact is that far away because of the lags for applied research, pilot plant studies and market introduction. But to a large degree the prosperity of the 1960s has already been shaped by the research programs now underway.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

This 487-ft. Barber-Greene Conveyor, one of five at the new plant, carries wet Gilsonite from the filter plant to the melt tank.

Barber-Greene Conveyors move Gilsonite faster, at less cost

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When material from the filter plant is not being fed to the melt tank (above, right), it is stockpiled by a Barber-Greene Radial Stacker to permit the plant to operate when the mine is shut down.

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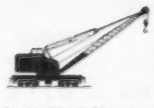

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AAF AMERjet salvages valuable dust at uranium processing mill

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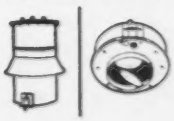

Cyclail Oil Bath Air Filters — Herman Nelson Unit Heaters

PERSONALS

Robinson

Mecia

J. A. Mecia and **C. W. Robinson** were recently appointed vice presidents of the Utah Construction Co. Mecia, formerly manager of mines, will continue in charge of the company's mining activities in the U.S. He is also a vice president and director of Lucky Mc Uranium Corp. and is a member of AIME, American Mining Congress and is presently vice president of the Uranium Institute of America. Robinson is vice president of Marcona Mining Co., Cia San Juan, S.A. and Ocean Services Inc.

Philip B. Smith was awarded the Royal Society of Arts' Fothergill prize for an essay recording "A New Method of Suppressing Fires in Mines", which was published in the society's Journal Oct. 25, 1957.

Earl H. Miller has been promoted to vice president of United States Potash Co. Miller, resident manager of the Carlsbad operation since July 1956, joined USP in 1951, prior to which he had spent 10 years in the Metaline district as mine superintendent for the Pend Oreille Mines & Metals Co.

Richard B. Nelson, most recently with Hidden Splendor Mining Co., has joined International Minerals & Chemicals Corp. as mine project engineer.

G. L. Jordan has been promoted to assistant general manager of National Potash Co., Carlsbad, N.M. He will continue as refinery superintendent.

J. H. Ashley, assistant general manager of Fresnillo Co., New York, has resigned and moved to California for health reasons, but will remain in a consulting capacity. **J. B. Stone,** formerly general manager, succeeds him; **F. W. Bailey** replaces Mr. Stone.

Lee A. Hammons, geologist, has been named field engineer for Department of Mineral Resources, Phoenix, to cover the northern part of Arizona. He was formerly with Kiva Explorations, Inc., Austin, Tex. as uranium geologist.

Dr. Olaf P. Jenkins, chief of California Division of Mines and state mineralogist for the past 11 years, retired Mar. 1.

Dr. W. F. James was recently named to the board of Dome Mines Ltd., Ontario, replacing **J. W. Stovel,** who has retired.

George R. McGrath has recently been appointed vice president and assistant to general manager of the White Pine Copper Co., Mich.

Hans A. Vogelstein, president of American Metal Co., was named president of American Metal Climax, Inc., formed recently by the merging of Climax Molybdenum Co. and American Metal Co. **Arthur H. Bunker,** president of Climax, is chairman. Also elected were **Harold K. Hochschild,** honorary chairman; and **Walter Hochschild,** vice chairman of the board, chairman of the executive committee, and chairman of the finance committee.

Walter Paige Arnold, until recently general manager of Freddies Consolidated Gold Mines in the O.F.S., has been appointed managing director of Algom Uranium Mines Ltd.

John Van Netten, secretary-treasurer of Rix-Athabasca Uranium Mines Ltd., has been appointed secretary-treasurer of Pronto Uranium Mines, Canada.

Henry L. McIntyre is new president of Pacific Industries, Inc., San Francisco, replacing Donald D. Smith, who resigned.

W. D. McMillan, mining engineer-geologist of Denver, Colo., who resigned after 17 years with U.S. Bureau of Mines, is now associated with two Denver firms as consultant.

T. J. Crocker, manager Bethlehem Mines Corp., Pa., since 1950, retired Jan. 31.

Harper Joy of Spokane, Wash., has been elected to the board of Sunshine Mining Co., replacing **Joshua Green,** Seattle, who resigned.

Donald M. Wagg has been appointed chief geophysicist for Rio Canadian Exploration Ltd. He will retain his position as operational manager of Gresham Exploration Ltd., also a Rio Tinto subsidiary, which maintains an electromagnetic prospecting unit.

H. Richard Whittall of Vancouver was elected a director of Granby Consolidated Mining, Smelting & Power Co. Ltd. **George Green,** formerly of Nelson, B.C., has been appointed mill superintendent of Cowichan Copper Co. Ltd.

E. L. Borup is president of the recently incorporated Blue Star Mines Ltd., which has acquired the former Wellington mine at Retallack, B.C. Other directors are **Samuel L. Klein** and **Fred J. Fillinger,** both also of Vancouver.

Charles R. Ince has been elected a member of the board of trustees of St. Joseph Lead Co. With the company since 1929, Mr. Ince was appointed assistant sales manager in 1931, sales manager in 1948, and vice president in 1951.

B. DeWitt Mitchell, geologist and petroleum production engineer, has been appointed Yucca Mining & Petroleum Co., Inc.'s new vice president. His office will be at the Colorado company's Albuquerque, N.M. headquarters.

A. J. O'Connor, vice president and general manager of Consolidated Coppermines Corp., was elected president of the Nevada Mining Association. **J. C. Kinnear,** retired vice president of Kennecott Copper Corp. and longtime president of NMA, was named honorary president. **John C. MacDonald,** resident manager of United States Lime Products Corp., and **Roy A. Hardy,** consulting engineer and vice president in charge of operations at Getchell Mine Inc., were elected first and second vice presidents, respecively. **Louis D. Gordon** was renamed executive secretary. Elected to the board were **Robert O. Jones,** western manager Standard Slag Co.; **John C. Kinnear Jr.,** general manager Kennecott Copper Corp., Nevada mines; **F. A. McGonigle,** vice president Manganese Inc.; **A. E. Millar,** general manager Anaconda Co., Yerington; **H. P. Willard** of Basic Inc., and **S. H. Williston,** vice president Cordero Mining Co.

Sheldon P. Wimpfen, formerly A.E.C. assistant director of the division of raw materials and manager of the Grand Junction, Colo. office, has joined Western Machinery Co., San Francisco, as general manager of the planning, research and development department. Mr. Wimpfen has also served as vice president of Glen Alden Corp., prior to which he was manager of AEC's program for finding, developing & production of uranium from domestic sources, and editor of *Mining Congress Journal* in Washington, D. C. He is a member of AIME, Mining and Metallurgical Society of America, American Mining Congress, and the Mining Club of New York City.

Wimpfen

Charles C. Goddard Jr. has been promoted to geologist in charge of Anaconda Co.'s Butte mines; **Wallace A. O'Brien** is now mines geologist.

W. W. Key, formerly of Darwin, is now at Mt. Isa with Metals Exploration N.L. **F. T. McDonald,** previously of Melbourne, is now with Mary Kathleen Uranium Ltd., Queensland, Australia.

G. M. Hetherington, until recently at Broken Hill, is now on the staff of Benguet Consolidated Inc., Baguio, P.I.

K. S. Cordwell, formerly of Darwin, has joined the staff of New Consolidated Gold Fields (Aust.) Pty. Ltd. in Sydney.

C. M. Richardson, formerly resident engineer, Waratah Gypsum Pty. Ltd., Stenhouse Bay, South Australia, has been appointed engineer at Cobar Mines Pty. Ltd., N.S.W.

J. B. Simpson, formerly Minister without Portfolio, has been sworn in as Minister for Mines, New South Wales.

D. F. Ainge, former assistant mine su-

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PERSONALS (*Continued*)

perintendent, Burma Corp. Ltd., Burma, has been appointed research engineer, New Consolidated Gold Fields (Asia).

Queneau

Cabell

Parlee

Waddington

Ralph H. Waddington, James C. Parlee, Richard A. Cabell and **Paul Queneau** have been elected assistant vice presidents of International Nickel Co. of Canada, Ltd., effective Jan. 1. Mr. Waddington has also been appointed general manager of the parent company's Ontario division and Mr. Parlee general manager of its Manitoba division. Simultaneously, the company announced that Ralph D. Parker, vice president in charge of Canadian operations, will move his headquarters from Copper Cliff, Ont., to recently expanded offices in Toronto early this year, from which he will continue to direct operations. Cabell and Queneau have been elected also as vice presidents of International Nickel Co., a subsidiary in the U. S.

Norton Jackson, who recently resigned as assistant chief superintendent, Research and Development Branch, South Australian Department of Mines, has accepted an appointment as assistant director, Technical Services Div., Cyanamid Australia Pty. Ltd. in Melbourne.

W. F. Talbot has been appointed a director of Uruwira Minerals, Ltd.

H. F. Oppenheimer has been appointed a director of General Mining and Finance Corp., Ltd., succeeding the late Sir Ernest Oppenheimer. He has also been elected to the boards of Central Mining & Investment Corp. Ltd., and Central Mining Finance, Ltd.

D. A. Etheredge has been appointed to the board of Chambishi Mines Ltd.

Richard R. Leveille, former crusher general foreman at Nevada Mines Div., Kennecott Copper Corp., has been named to head the new production and quality control department.

George W. Streepey has been named assistant general manager of Aluminum Co. of America's mining division. He was division production manager for the past four years, and previously managed the Surinam plant operations. Succeeding Mr. Streepey is **Robert S. Overbeck,** a Columbia University mining engineering graduate from Baltimore, Md.

Dr. Aaro E. Aho, geological engineer, has started a consulting practice at North Vancouver, B.C. His 10 years' experience includes teaching of geology at Oregon State College, reconnaissance mapping with Geological Survey of Canada, mining exploration manager for British Yukon Exploration Co. Ltd, in Yukon and northern B.C. and consulting work. His wife, a geologist, assists.

H. A. Pearse has resigned from Howe Sound Co. as vice president in charge of metallurgy and construction. He plans to engage in private consulting work in the metallurgical field.

Frank P. Jones was promoted, effective Jan. 1, to chief chemist of the Washoe Sampler of Anaconda Co., succeeding **Milton A. Reid,** retired.

A. G. Kirkland, former manager of mines for western operations of USSR&M, Co. Salt Lake City, has been named to newly created post of manager of mines of Howe Sound Co.

Edward P. Shea, head of Butte Mines geological department for past six years, was appointed to newly created position of chief geologist, Montana Div. of Anaconda Co. Jan. 1. Recently Shea also was elected chairman of the Montana section of AIME, succeeding Stan Lane, superintendent of Asarco's East Helena plant.

Other officers named were: **J. J. Dougherty,** Anaconda, vice chairman; **C. J. Hicks,** Butte, reelected secretary-treasurer; **George Hanson, Guy Wever** and **John Warren,** executive committee members.

Dr. Walter R. Landwehr, chief geologist and acting manager of western mining department of Asarco., retired Jan. 1. **J. F. Frost,** mining engineer, succeeds him as manager, and **W. P. Hewitt,** assistant chief geologist, was named senior geologist.

Morley Romanuck, geologist, formerly with Quebec Cartier Mining Co., has joined the W.S. Moore Co., Duluth, Minn.

Glen A. Boyd, St. Paul geologist with Northern Pacific R.R., has been transferred to a new Seattle branch office.

E. W. Peterson was transferred to Caland Ore Co. at Steep Rock Lake, Atikokan, Ont. in the newly created position of mechanical superintendent. **Robert W. Edwards** succeeds him as superintendent at Inland Steel's Sherwood mine, Iron River, Mich.

Hugo Korpinen, of Ishpeming, has been appointed general superintendent of Cleveland Cliffs Iron Co.'s Michigan mines.

Charles W. Lockerbie and Mrs. Lockerbie, mineralogists, have presented their lifetime collection of 1,100 specimens to Westminster College, a Presbyterian school in Salt Lake City.

Jerry Bryant, foreman at Mines Development Inc., S. D., was appointed superintendent of Fremont Minerals Inc.'s new uranium mill at Riverton, Wyo.

Arthur E. Granger and **Charles E. Tonry** have been named directors, respectively, of the newly reorganized production evaluation division and the source materials procurement division of AEC's Grand Junction Operations office. These two units replace three former operating divisions: Mining, Exploration and Concentrate Procurement.

R. Dennison Coursen was appointed director of The Malayan Tin Bureau in Washington effective Jan. 1, replacing **Lynn W. Meekins,** who retired.

Obituaries

Marshal Candido Mariona da Silva Rondon, 92, explorer of the Brazilian west, expert on Indian affairs and one of Brazil's most important figures of the 20th century, died Jan. 19.

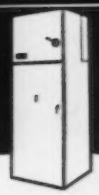
Scott Keenlyside, 47, Vancouver industrialist and founder and director of Western Canada Steel Ltd., died in Vancouver Jan. 8.

H. Kenyon Burch, 84, retired mechanical and metallurgical engineer, died in Los Angeles, Dec. 30, after a long illness. During an active career which began with Anaconda Mining Co. in Montana in 1901, he designed and constructed rushing and concentrating plants for Detroit Copper Co. at Morenci, Ariz., Montezuma Copper Co. at Nacozari, Mex.; designed a large plant for Miami Copper Co., completed work for Inspiration Consolidated Copper Co. And had also acted as director and consulting engineer to United Verde Extension at Jerome, Ariz. Later, he was consulting engineer for Phelps Dodge Corp. in charge of the Copper Queen and in 1922-23 in charge of design at New Cornelia Copper Co., Ajo, Ariz. Mr. Burch was a member of the ASME and AIME.

Roswell W. Prouty, 67, a member of the AIME until a stroke in 1955, died Jan. 9 in Pasedena, Calif. after a long illness. Mr. Prouty had done extensive work in Central and South America and Russia and was minerals attache in Mexico City for the U.S. Department of State from 1940 to 1946.

Dr. Joseph A. Bancroft, 75, distinguished geologist, whose name has been given to the Copperbelt's youngest producing mine, died in Johannesburg, Dec. 11.

Newly designed
Type H Motor Control



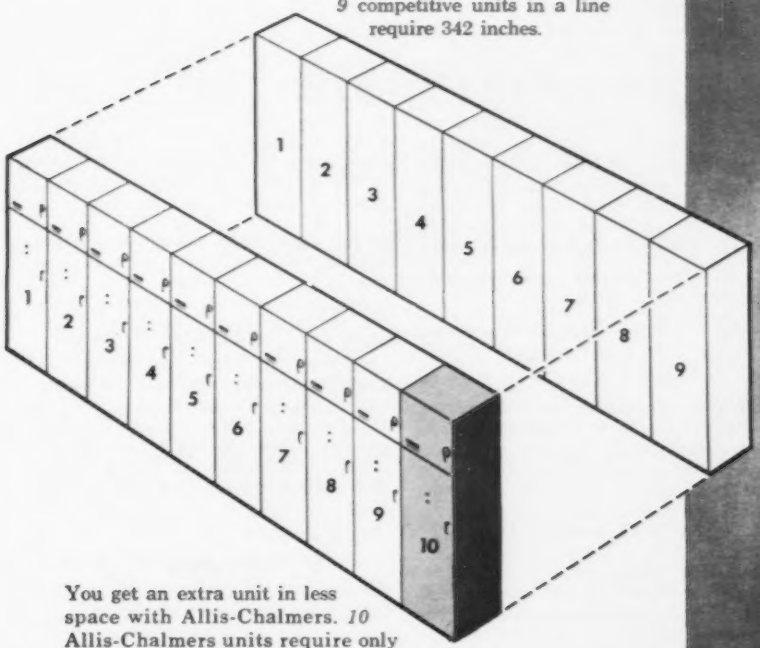
Saves valuable plant space

Newly designed Allis-Chalmers high voltage control units are only 34 inches wide. This means you can put 10 Allis-Chalmers cabinets in less space than required by 9 competitive 38-inch units. In addition, the narrower width means less space required for door swing. Result: You save a total of 2.36 sq ft of floor space per unit. On 10 units, this means a saving of 23.6 sq ft.

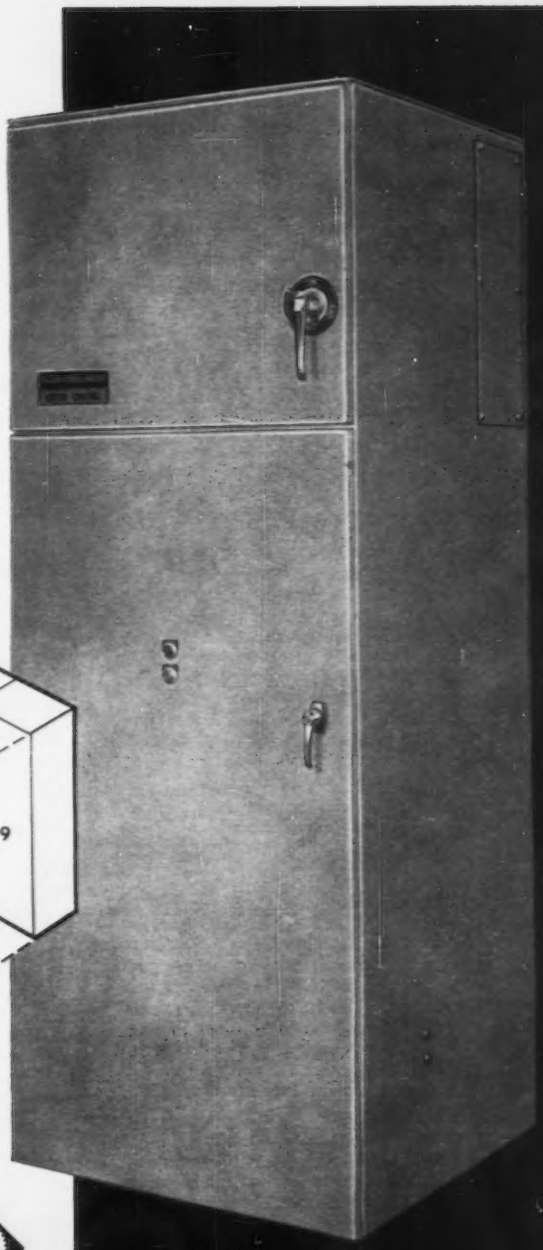
Smaller size is only one of many advantages in this new Allis-Chalmers design. You also get full-front access, more room for optional features, a completely tested unit, and the ultimate in protection for men and machines.

For more information on how this new control design can help you, call your nearest Allis-Chalmers representative, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

9 competitive units in a line require 342 inches.



You get an extra unit in less space with Allis-Chalmers. *10* Allis-Chalmers units require only 340 inches.



ALLIS-CHALMERS

A-5518

PERSONALS (*Continued*)

Dr. Bancroft was a native of Cape Breton Island, N.S., educated in Canada and studied at Acadia, Yale, Leipzig and Bonn Universities. During his career he taught geology at McGill, and investigated mineral deposits in Canada and the U.S. In 1927 he was in charge of Anglo American Corp.'s prospecting in Northern Rhodesia, and remained consulting geologist in Northern Rhodesia and Johannesburg until 1952, when he retired, though he was retained as a consultant. He was author of numerous reports and papers on geology.

Herbert A. Sawin, 63, sales engineer for the Yuba Manufacturing Co., and a former resident of Benicia, Calif., died in an Oakland hospital in December after a long illness. Mr. Sawin received his early engineering training at the Cramp Shipyard, Philadelphia, during World War I, and joined Yuba Manufacturing Co. in 1922. Mr. Sawin was a past president of the San Francisco section of the AIME, and of the Engineers Club of San Francisco.

Dr. John T. Williamson, 50, Canadian geologist who discovered the richest privately owned diamond mine in the world under the clay of an East African plateau, died Jan. 7, in his home in Tanganyika. His London agents said he died at his six-square mile diamond claim at Mwadui, Tanganyika, which he discovered in 1940, after prospecting for six years in parts of Africa rarely visited by white men. He had a geology degree from McGill University. Though he had been offered $5.6-million for his mine in 1942 by DeBeers Consolidated Mines, Ltd., run by the late Sir Ernest Oppenheimer, he refused to sell. Soon after 1952, when he tried to sell his diamonds at a high price in London where reportedly dealers were afraid they would lose favor with DeBeers, he joined interests with DeBeers after failing to sell a stockpile of $16.8-million worth of diamonds. Mwadui at the time had an estimated production of 5% of world's cuttable diamonds.

An Appreciation

Wm. A. Beaudry, 79, passed away in Seattle Dec. 22.

At Thanksgiving and Christmas, while superintendent of the Senator Stewart Mine west of Kellogg, Idaho circa 1914-1917 he passed out a turkey to each of 200 workmen with the compliments of F. Augustus Heinze. With 15,000 tons monthly production—no mine in the Coeur d'Alene mining district has ever equalled the low-cost production as did the Stewart during the tenure of Bill Beaudry.

Here, too, when he was testifying in a trespass action—when asked by an opposing attorney why he had not stopped a certain "Sheep's Crook" crosscut before it entered the adjoining claim, answered, "Mr. Heinze instructed me to run the crosscut and not to stop it until he gave me orders to do so. When it was near the line Mr. Heinze died and as there was no one to stop me, I kept it going." His reply, greeted by a laugh even by the judge, so completely upset the plaintiff's contention that the crosscut had been run "for the willful purpose of extracting ore from the adjoining claim," that the matter was dropped immediately.

Bill Beaudry had but little formal schooling yet his knowledge of mineral deposits was outstanding. As a young man of 200 pounds he had a marvelous physique. He bested professional wrestlers. He was a champion single-jacker—19¾ inches in hard granite in 15 minutes—and won championship matches in double-jack drilling.

On one contract driving a double compartment raise he made more footage with single-jack and hand steel than did crew miners with machines in nearby mines. To substantiate the monthly footage when being measured by a company engineer, he was obliged to say his crew consisted of three men. In driving a crosscut by hand he was known to drill the entire round of holes except the lifters drilled by a partner.

Aside from numerous mine activities in the Coeur d'Alenes—all successful—he opened up and operated a defunct gold mine in Oregon during the depression, paid off its indebtedness and made it pay dividends. During the early 40's he proved the possibilities of the Sidney Mine on Pine Creek doing a large part of the work himself. He remained Sidney's vice president until his death.

With the demise of such men as Bill Beaudry we may well note the Passing Parade. The industry will probably not see his like again. We shall miss his long intricate recitations of French-Canadian poetry, his tales of the Homestake Mine where he worked as a hand-miner as a boy—but mostly we shall miss him for what he was—a great man.

He leaves two daughters and four grandchildren, all of Seattle.

Spokane, Washington

Frank V. C. Hewett, 50, president of McIntyre Porcupine Mines, Ltd., and board chairman of Ventures, Ltd., died at his home in Toronto, Dec. 27. Hewett, one of Canada's best known consulting engineers, had directed McIntyre's recent expansion—acquisition of control of Ventures, Ltd., a holding company with world-wide mining interests, and a $50-million investment in the Algoma Steel Corp. He was graduated from the University of Toronto as a mining engineer in 1933, and for seven years was field editor of *The Northern Miner*. During World War II he was metals controller and executive secretary of the joint U. S.-Canada Raw Materials Coordinating Committee, and director of nonferrous metals in the Department of Defense Production during the Korean War. In 1956 he was appointed general manager of McIntyre and subsequently became president and managing director. For a short period in 1957 he served as president of Ventures before becoming chairman. He was chairman of the Toronto branch of CIM and executive director of the sixth Commonwealth Mining Metallurgical Congress.

Patrick B. Hyland, 83, a former general foreman of Lark mine of the Bingham Mines Co. and later United States Smelting & Refining Co., died Jan. 1 in a Salt Lake City, Utah, rest home. He had retired in 1941. While foreman for the Delamare mine at Mercur, Utah, he introduced the timberless system of block caving in the U. S., which was first used at Utah Copper until 1910, when the property was converted to an open pit.

John F. Berteling, 68, of Orange, Calif. and former superintendent of Palms-Anvil mines of Pickands, Mather & Co., Bessemer, Mich., died Nov. 27.

George Edwards Cole, 78, former director of mines for Manitoba and past president of the Canadian Institute of Mining and Metallurgy, died in Winnipeg, Dec. 11. An outstanding authority on mining legislation in Canada, Mr. Cole had joined the Ontario Dept. of Mines in 1920, was appointed director in 1930, and retired in 1945.

Clair O. Evans, 64, metallurgical engineer at Phelps Dodge Copper Products Corp., died Dec. 8, at Wickersham Hospital in New York, after a long illness. Mr. Evans, who lived at 30 Fifth Avenue, New York City, had been with Phelps Dodge for 41 years. He was past chairman of ASME's prime movers committee and also secretary of ASME's condenser tube research committee.

Henry C. Diers, 90, pioneer Alaska and Washington State mining engineer, died Jan. 7, at Mount Vernon, Wash., after a long illness. Mr. Diers was a surveyor for Northern Pacific Railways at Tacoma for 12 years; went to Alaska in 1895 where for seven years he published the *Alaska Daily Guide* and the *Alaska Mining Journal;* specialized in oil and fuel flotations in Oregon from 1914-1922 when he moved to Bellingham, Wash., where he researched in Pacific Northwest mineral resources, retiring in 1942.

LETTERS

Industry Looks At Direct Reduction

Will you please send me a reprint of your article, an excellent comprehensive review.

Russell C. Phillips
Senior Chemical Engineer
Stanford Research Institute

As you may surmise from the enclosed reprint [of an article written by Mr.

DROTT 4-IN-1 SKID SHOVEL built lighter and stronger with USS "T-1" Steel. Can be used as a bulldozer, bull-clam shovel, clamshell or skid shovel. Can load trucks or freight cars.

"T-1" Steel reduces weight of 4-in-1 bucket by 35%, boosts payload by 1,200 pounds

"Our engineers specified USS 'T-1' heat treated alloy steel in the construction of our 4-in-1 skid shovel bucket because we could reduce the original weight by 35%. What's more, we could add one-half yard to the bucket capacity," says Mr. Edward Drott, President and Chief Engineer, Drott Manufacturing Corporation, Wausau, Wisconsin.

The entire Drott bucket is fabricated from USS "T-1"* Steel which has a minimum yield strength of 90,000 psi, nearly 3 times that of structural carbon steel. This strength helped to make the weight reduction possible . . . and the reduced weight on the front end of the tractor improved the balance and increased efficiency.

50% longer wear. Drott buckets made of "T-1" Steel have now been in rugged service about two years. Because of "T-1" Steel's high resistance to impact abrasion, the buckets will last 50% longer than those made of lower strength steel.

Strength after welding. USS "T-1" Steel was found to retain its strength after being welded or flame cut. This was an important factor in design.

Sub-zero toughness. Even at 50° below zero, USS "T-1" Steel retains its high resistance to shocks and jolts in rugged work.

Build better with USS "T-1" Steel. No other steel possesses the remarkable combination of high yield strength, toughness and weldability found in "T-1" Steel. It may be the answer to your problems for many different types of mining and construction equipment. *Remember that we also make* USS COR-TEN*, USS TRI-TEN* *and* USS MAN-TEN* *high strength steels . . . standards for heavy-duty equipment.* United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

**Registered trademarks.*

USS United States Steel

PERSONALS (*Continued*)

Hayward on direct reduction in *E&MJ*, January 1952], I found your article of great interest. I have been convinced for many years that some method of gaseous reduction would be applied to high grade ores or concentrates. When hydrogen is used, its activity allows pre-sintering of fine materials—which is the basis of the process that I propose.

One of the greatest disappointments in my research career was that the lack of funds prevented the carrying out of this process through a real pilot plant test.

Carle R. Hayward
Department of Metallurgy
Massachusetts Institute of Technology

I read with considerable interest your article. I am enclosing a copy of an address I made in Chicago in December last, containing my own opinions on these processes. I appreciate the difficulty of preparing such an article, but would comment as follows:

1. Situation at Monterrey, Mex., has advanced considerably.
2. Costs quoted for H-Iron are very optimistic.
3. The drawing of the Cyclosteel furnace is not accurate.
4. The drawing of the Wiberg-Soderfors furnace first appeared in the enclosed reprint [Mr. Cavanagh's paper on direct reduction, *Iron Age*, June 2, 1949], and was drawn by me.

P. E. Cavanagh, director
Dept. of Engineering and Metallurgy
Ontario Research Foundation
43 Queen's Park
Toronto 5, Ontario

• Our apologies to Mr. Cavanagh, Mr. Cope and *Iron Age* for incorrectly crediting the Wiberg-Soderfors drawing. Our drawing of the Cyclosteel furnace is actually a drawing of the British Coal Utilization Board's coal burner, from which the first Cyclosteel furnace was designed. If interested in the paper presented by Mr. Cavanagh, and in the direct reduction process developed by the Ontario Research Foundation, write direct to Mr. Cavanagh at the address above.—Ed.

You forgot our process — the Halverson Process being evaluated by Tandem Mines Ltd., 25 Adelaide Street West, Toronto, Ont. See U. S. Patent No. 2,792,299.

Donald A. Keith
President, Tandem Mines Ltd.

We would like to obtain four reprints.

D. A. Sutch, President
Ramseyer & Miller, Inc.
Consultants—Iron and Steel

May we offer later information on the Krupp Renn Process that appeared in your article? Economics of the process depends almost entirely upon the raw material cost situation of any particular area. It cannot be said that this process is cheaper than any other process except only after complete evaluation of the local situation.

On the last page of the article, you stated the location of the Krupp Renn plants and that these have been dismantled after the war. The latest information on this particular subject is that a three-kiln plant now exists at Salzgitter, Germany.

Spain has a plant treating low-grade iron ore with anthracite. A plant exists in Greece, treating nickeliferous ores. In addition, a new multi-kiln plant is being erected at Borbeck, Germany. These installations are in addition to those already in existence in Czechoslovakia and the Far East.

The Krupp Renn Process is in economic operation on a large scale in several countries of the world.

R. T. Miller
Southwestern Engineering Co.

You didn't include the Udy Process.

J. C. Udd, President
Strategic Materials Corp.
Toronto, Ontario

Dr. H. R. Hanley has brought to my attention your excellent article. Due to the interest in our State in this material, I am wondering if you can send me four reprints, so I can distribute them to interested parties.

D. S. Eppelsheimer, Professor
Dept. of Metallurgical Engineering
School of Mines
University of Missouri

• Reprints are available — Ed.

Call It "Confiscation"

The article in your November issue, entitled "Empresa Minera de Catavi Concentrates Tin Ores," is both pitiful and disconcerting. Pitiful because it demonstrates to those who know this great mine the complete absence of coordination (since confiscation in October 1952) between departments in the operating organization, which can only result in general inefficiency and high costs. Disconcerting because the American taxpayer is called on to meet the deficits due to these inefficiencies and errors in judgment of a leftist Bolivian government. A few remarks will be made to substantiate these statements.

The mine contains ores of very distinct metallurgical characteristics. The barren rock in the rhyolite porphyry ores has a specific gravity of 2.62-2.65; so that a piece of rock having sufficient minerals content to increase its specific gravity to 2.70-2.72 should be recovered by any preconcentrations process if satisfactory recovery is to be attained. The barren rock from the contact metamorphic deposits has a gravity of 2.72 or more. Obviously, a mixture of these two types of ores cannot be treated successfully in a heavy medium separator; but there is no difficulty in treating the two separately by altering the gravity of the medium accordingly.

When the mines were seized in 1952, those individuals placed in control of the Catavi operation of Patino Mines & Enterprises disregarded completely the plans and preparation made by the former operators to keep the various types of ores apart until after the heavy media separation. The milling department, having a limited perspective of the operation as a whole, and frustrated by the inevitable concentration problem confronting them, attempted to solve their problem by constructing, at considerable expense, a jig plant to treat the product from the heavy medium plant. Higher costs and a serious loss in recovery resulted. Nor was the construction of the jig plant to treat slimes any more justified, your published article to the contrary notwithstanding. There are fundamental reasons why a slime jig plant cannot better the economic results of Sullivan tables.

If the present Bolivian regime, after confiscating the major tin producers, wiping out free enterprise, banning the free press, exiling political enemies, confiscating private property for political revenge, and otherwise following the doctrines of Karl Marx, had accepted the consequences of their own follies and stewed in their own juice, all the inefficiencies, higher costs and low recoveries would be of little concern to most Americans. Instead, this leftist Bolivian regime cried for help to our State Department and, ever since confiscation of the mines, have been receiving more than $30,000,000.00 annually to perpetuate the Marxian principles that we Americans so vehemently oppose. Our State Department may be applying soothing syrup to the Bolivian problem because other sections of the world are more dangerous to the U. S. A., which would explain support of a government with contrary ideals. However, I fail to see justification for any support or encouragement to the present Bolivian regime by the engineering fraternity.

It will be noted that "confiscation" and not "nationalization" has been used to describe the action of the Bolivian government in taking over the major tin producers. To date the Bolivian government has paid Patino Mines & Enterprises for the seized Bolivian assets, which could not be replaced today for fifty million dollars, little more than a just interest rate on the value of the warehouse and commissary stocks alone. Is there a better word for such action than "confiscation"?

In view of the foregoing, do you not concur that the article, "Empresa Minera de Catavi Concentrates Tin Ores," is both pitiful and disconcerting to America —especially its engineers? It is not within the scope of this letter to comment on the complete failure to better the social condition and real wages of the workmen as promised when the mines were confiscated. Nevertheless there is a lesson to be learned for engineers interested in foreign operations.

DeWitt C. Deringer
Former General Manager of
Patino Group of Mines

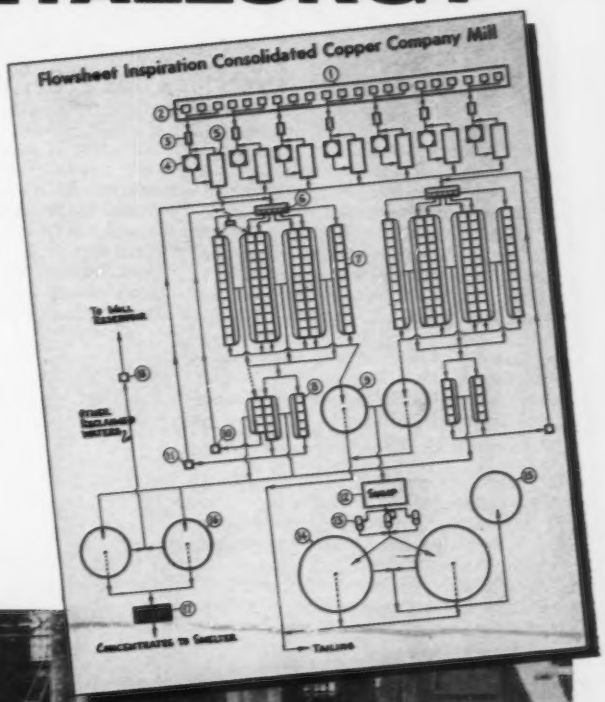
(*Continued on page 214*)

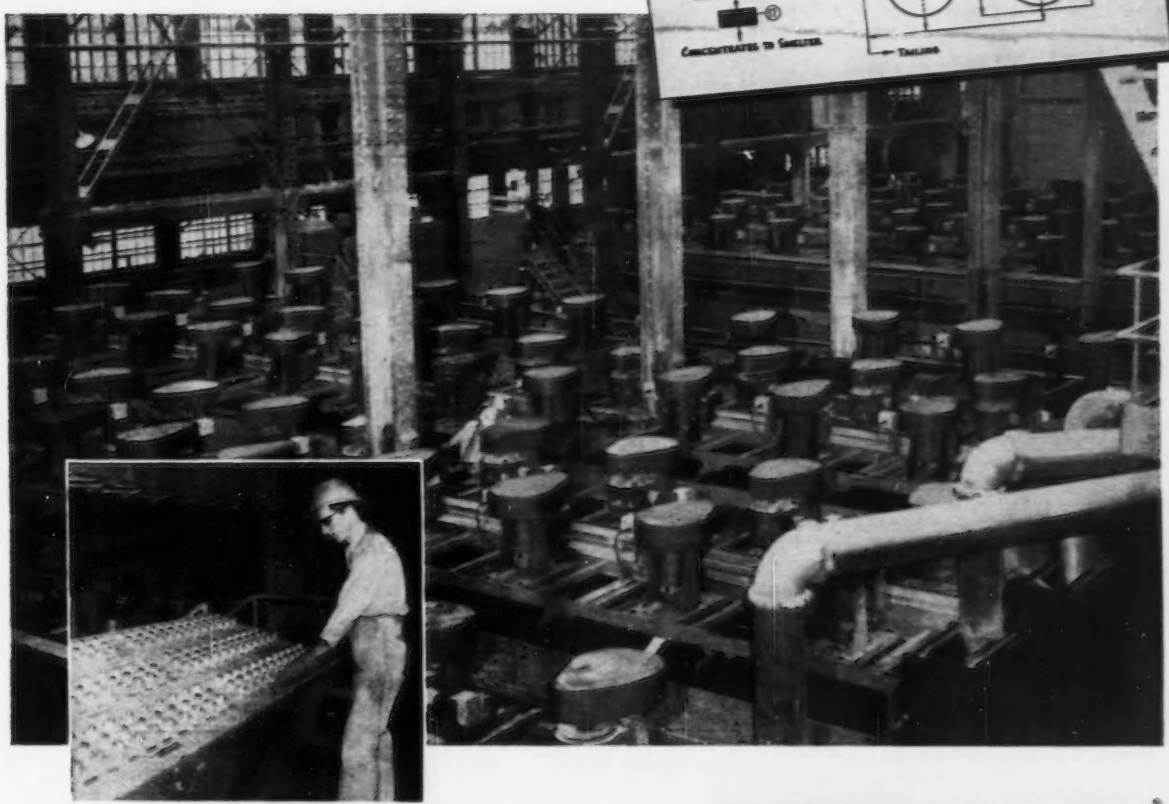
INSPIRED METALLURGY*

extends INSPIRATION'S reserves

A new lease on life has been achieved by Inspiration Consolidated Copper Company, Inspiration, Arizona, through the complete rehabilitation of facilities idle for over a quarter of a century. Below are some of the highlights of the operation. For complete details, write for Wemco Bulletin F5-B30. A-1

* **Dual Process, using acid leach for oxide fractions and flotation for sulphides.**
* **Increase in capacity, originally 10,000 tons, now 15,000 tons of ore per day.**
* **Simple flow sheet, with unique test circuit providing for a 2,500 t.p.d. pilot plant within the commercial circuit.**
* **Wemco-Fagergren flotation machines used throughout; 144 cells for roughing, 24 for cleaning.**





Wemco Fagergrens are controlled from a console, with a separate indicator for each unit.

WEMCO

WESTERN MACHINERY COMPANY
650 FIFTH STREET
SAN FRANCISCO 7, CALIFORNIA

Representatives in principal cities

Bretz Mine Gets Large-Scale New Reactivation

UTILIZATION of flotation in treatment of mercury ores plus a better price than evident in war periods, has brought about successful operations at Bretz mine in Malheur County, Ore.

The operation is handled by the Arentz-Comstock venture headed by Samuel S. Arentz, mining engineer of Salt Lake City, Utah.

It is now poised on a program of profitable treatment of even lower grade ore through wet screening which would eliminate the bulk of the opalite mineral after crushing. This would increase run to flotation of finer matter containing values.

Arentz, a former official of Combined Metals Reduction Co., Salt Lake City, is responsible for putting the Bretz mine on its feet after considerable negotiation with various parties.

The producers in the district, principal of which is the Cordero mine, all utilize direct roasting of mercury ores.

This also was the process employed in past at the Bretz mine, discovered in 1917 by William S. Bretz. For many years, the "Bretz" was confined largely to mere payment of assessment work and to surface prospecting.

What Bretz first had found turned out to be "opalite" outcrops. This very hard quartz-like mineral containing quicksilver values is not amenable to economic grinding for flotation.

However, in 1931, Bretz discovered more friable, high-grade ores in the nearby soft lake beds adjacent to the original locations. This property was leased to the Bradley Mining Co. of San Francisco, which carried out mining on an open pit basis. The ores were not floated, but reduced in conventional furnace. Some 7,751 flasks of mercury, according to Howard C. Brooks, field geologist in the department of geology and mineral industries of the State of Oregon, were produced between 1931-1956.

It was believed in the latter year that mineable reserves had been exhausted at the Bretz—although there had been shallow exploration pits or shafts sunk on a spot where later operators opened up sizeable reserves.

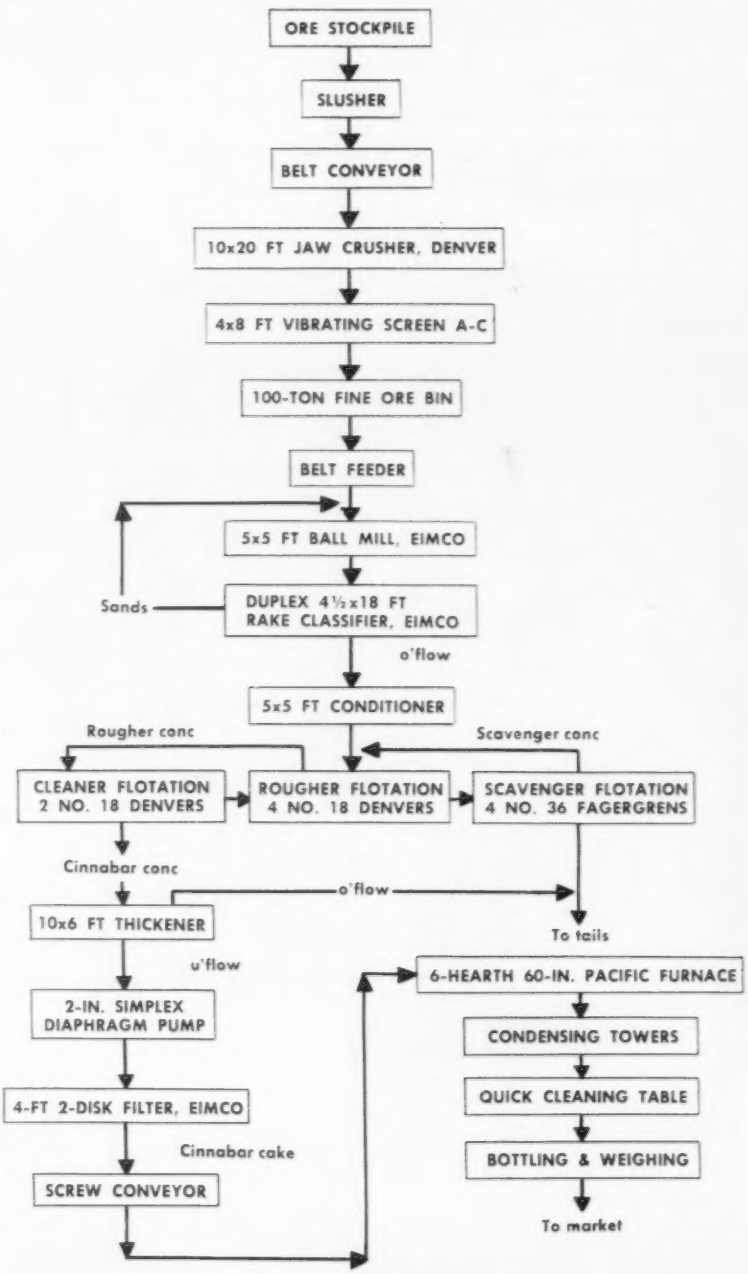
The Bretz was re-located in a period of rising quicksilver prices by McDermitt rancher John Ruiz. In negotiations that followed, Arentz and Comstock Uranium and Oil Co., Salt Lake City, obtained operating interests with Shawano Development Corp., New York.

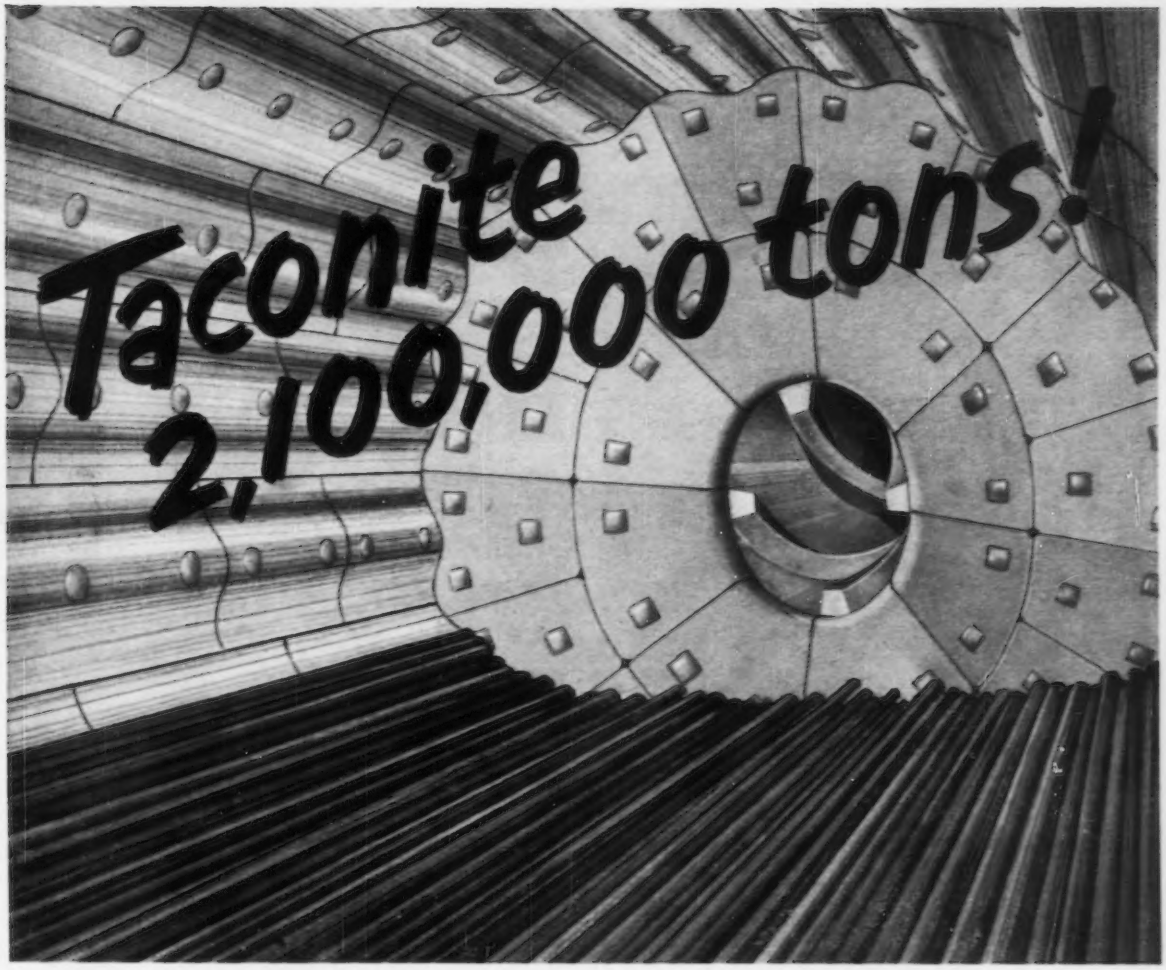
The Bretz operation as now constituted was launched in April 1956, and the stripping of ores is carried out by Wells Cargo, Inc., Nevada trucking and contracting concern. At present there are sufficient ore reserves to carry the 150-tpd mill erected by the Arentz-Comstock venture through 1958.

A considerable quantity of lower grade material has already been developed, promising a longer life to the property. By removing plus 16-mesh material by wet screening the imput to the mill can be increased by some 75%, Arentz says.

Metallurgical work on the mill was completed by Keith Kunze, general superintendent of the Getchell Mine, Inc., located at nearby Golconda, Nev.

Decision to employ flotation, rather than standard roasting processes for treatment of Bretz ores, was based on the excellent metallurgical results obtained by Kunze on the high moisture content of the ore (20-25% H_2O as mined). This water content caused high oil fuel consumption in furnacing in





ABK **METAL** *Liners Cut Per Ton Grinding Costs for Taconite 48% Below Best of Five Other Materials*

Taconite! Hardest, most abrasive ore the mining industry handles. It chews up grinding equipment and faces tough competition from other iron ores. Per ton costs of processing taconite are a number one problem.

*ABK Metal liners in the rod mills of a large Minnesota taconite producer using 4 in. rods have improved production runs and brought new economy to taconite grinding. Long-wearing ABK Metal liners have ground more than 2,000,000 tons. Costs per ton of taconite ground are 48% under the best of five other materials used (see box). Taconite milling costs are down, runs are longer, fewer replacements are needed.

Taconite mine operators agree, "If you can mill taconite you can mill anything." ABK Metal shell and end liners help get the job done at far lower cost. Wherever extreme abrasion is a problem ABK Metal parts have consistently outperformed other "abrasion resistant" materials. For information on how you can cut costs in your plant with long-wearing ABK Metal parts, call your local Engineered Castings Division representative.

Tons of Taconite Processed with Other Materials
Chrome-Manganese . . 1,079,003
Ni-Hard 1,095,000
Chrome-Moly (Type 1). 917,239
Rolled Steel 1,030,000
Chrome-Moly (Type 2) 962,514

**ABK Metal, produced only by Brake Shoe, is a nickel-chrome iron of controlled structure, possessing outstanding abrasion-resistant properties.*

AMERICAN Brake Shoe COMPANY

A-7494

ENGINEERED CASTINGS DIVISION
1219 Main Street, Melrose Park, Ill.

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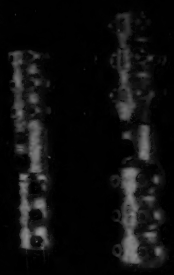
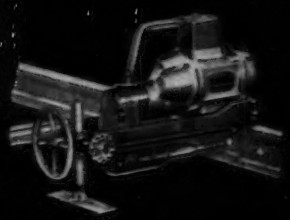
☐ *A Library of Information*—O-B Haulage Ways brings 8,000 mining men "how-to-do-it" articles and new product information every month. Just check the box to add your name to the list.

☐ *Aluminum Feeder Cable*—Supplement No. 1 to the O-B No. 27 Catalog lists O-B fittings for aluminum cable and describes correct installation procedures. Check box for your copy.

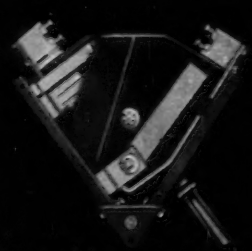


1. Cable Connectors



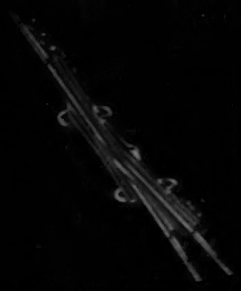
5. Rail Drills for Wedge Bonding

10. Porcelain Insulators



15. Feeder Safety Switches (Cover Removed)

19. Rail Clamps



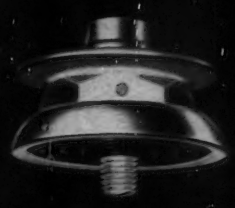
2. Trolley Frogs, Crossovers

3. Expansion Bolts

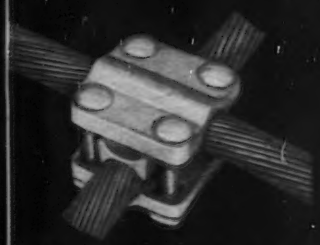
4. Automatic Couplers

6. Trolley Wire Clamps

7. Hanger Adapters

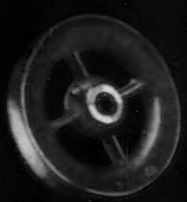


8. Insulated Hangers



9. Branch Connectors

11. Trolley Wire Conditioning Equipment



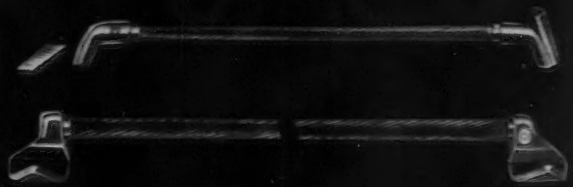
12. Wheel Collectors

13. Feeder and Trolley Splicers

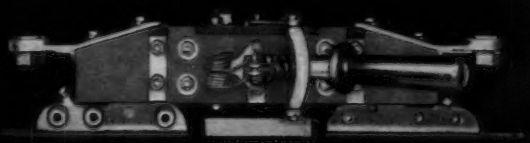
14. Quick Break Switches

16. Shoe Collectors

17. Fused Taps



18. Rail Bonds



20. Section Insulator Switches

21. Combination Feeder Trolley Clamps

22. Bond Welding Equipment

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★ 9 Shaft Arrangements

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Bretz Mine *(Continued)*

past treatment of Bretz ores. The lower capital cost of flotation as against large kilns was also an important item in plant construction considerations.

The process is working satisfactory and to date it appears the decision was a correct one for the type of ore encountered at the Bretz property, Arentz said.

According to descriptions of the process furnished by the operators, ore is fed by scraper through an 8-in. bar grizzly where the small amount of over sized opalite "boulder" is removed. The oversize from the screens—at present about 25% of the feed (without wet screening)—is fed into a 10x20 in. jaw crusher with fines and crushed material later being removed to a 100-ton, circular storage bin.

SAM ARENTZ heads the firm which has reactivated and boosted production from the 41-year old discovery.

Ore from the bin is ground to 90% minus 48-mesh in a 5x5 Eimco ball mill in a closed circuit with double rake classification.

Classifier overflow goes to conditioner tank and then to a six-cell flotation machine.

The flotation concentrates contain 50 to 60% mercury by dry weight and are pumped to Eimco 10x6 thickener and thence through diaphragm pump to a 4x2 Eimco filter. The cinnabar cake travels via screw conveyor to the Pacific Furnace.

Recovery is high with less than half pound of mercury lost in the process.

Under present methods of beneficiation, ore as low as 2½ lb of mercury per ton can be run to mill.

Basic Research Center Set at Montana Mines

PLANS TO CONSTRUCT, equip and staff a new $2-million center for conducting basic and applied scientific research in the mineral and allied industries were announced by the Montana School of Mines Research and Development Foundation, Inc.

The center, which would be located in Butte in the immediate vicinity of

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...and Sure to Win Their Way to the Heart of Industry

Many optional features, including built-in power steering, add to the versatility of the "440" Wheel-Type.

Ruggedness, power, operator's comfort, and all-around economy are featured in the new "440" Crawler.

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Every inch another "thoroughbred," the new John Deere "440" is a worthy "stablemate" of the ever popular John Deere "420," the busy, capable, and economical crawler that continues to merit the praises of efficiency-minded industrial users everywhere.

With a capacity for work that must be seen to be believed, combined with a nimbleness that cuts maneuvering time drastically, they have the ability to squeeze more work out of every piece of equipment and to press more work into every hour.

HERE they are . . . trim and eager . . . and literally "born" to save you money, whatever business you're in—the New John Deere Industrial Tractors.

"Born" to save you money?

We could hardly put it better. For these are INDUSTRIAL tractors from top to bottom . . . ruggedly built from grille to drawbar . . . and designed, inside and out, to fill definite needs in industrial work of all types . . . to cut to rock bottom the costs of such jobs as earth moving, materials-handling, sand and gravel work, mowing, maintenance, and many other—often specialized—jobs in contracting, construction, utilities, manufacturing, and public works.

Both tractors are built around an amazingly efficient John Deere engine, unmatched for delivering so much, for so long, for so little cost. Both have many construction features of hood, grille, frame, and either wheel or track assemblies—plus optional new clutch-type direction reverser—that enable them to do more than their share of the day's work of pushing, pulling, lifting, digging, and hauling. Their clean, modern, functional design throughout makes them businesslike in operation, easy to service and economical to maintain. A line of proved, matched working equipment gives them the versatility that industry demands.

Size up these modern tractors in the light of your requirements. It may be the start of making your power dollars go farther than you thought possible.

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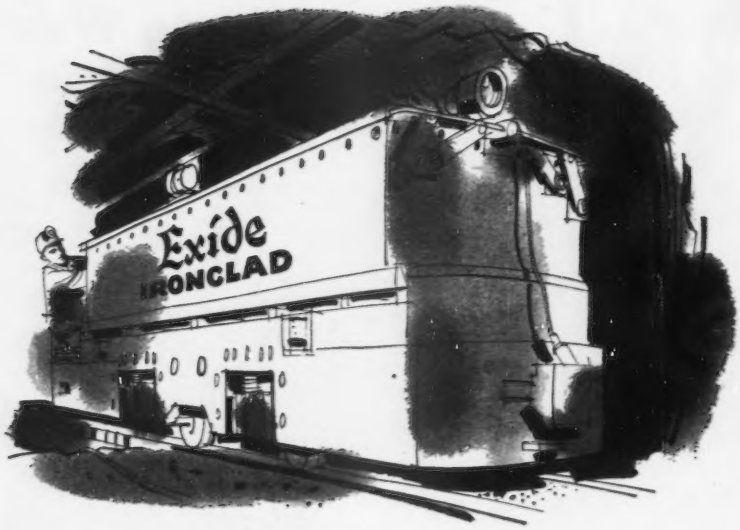

EXIDE-IRONCLAD BATTERIES

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More ton-miles per dollar—that's the reason most cost-conscious mine operators prefer Exide-Ironclad Batteries for mine locomotives.

Experience has proved over the years that no other battery make matches Exide-Ironclad for average life in service and tonnage hauled. Rating for rating and dollar for dollar, Exide-Ironclad gives you more real value . . . more return on your investment.

Today's Exide-Ironclad features improved tubular construction, making it even better than the models that chalked up the industry's records. So you can expect even longer life potential and superior performance.

Total work output, not mere price, is the key to battery economy. When you buy batteries, specify Exide-Ironclad and get the most production capacity your dollar can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

High-capacity, long-life tubular construction. Gives positive plate one-third more surface area for greater power reserve. Power tubes hold active material securely for long battery life.

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Research Center (*Continued*)

Montana School of Mines campus, would be concerned primarily with research in the fields of geological, mining, mineral dressing, metallurgical and petroleum engineering with a view toward aiding industry by finding new techniques or more fully exploring familiar paths in production, the announcement said.

The foundation is headed by John W. Warren, of Butte, as director. Roger V. Pierce of Salt Lake City is chairman and associate director, and Dr. Arthur E. Adami of Butte is associate director. Warren is chief ventilation and industrial hygiene engineer in Butte for the Anaconda Co.; Pierce is a mining consultant, and Dr. Adami is dean emeritus of Montana School of Mines.

In addition, the newly-formed foundation lists an advisory and investment committee of Chester H. Steele, vice president in charge of western operations of the Anaconda Co.; John E. Corette, president and general manager of the Montana Power Co.; E. P. Frizelle, president of the Metals Bank and Trust Co; Rayworth F. Howe, vice president and manager of the Christie Transfer and Storage Co.; Murl H. Gidel, geological consultant now and until his recent retirement the Anaconda Co.'s assistant chief geologist for North America; Howard A. Johnson, attorney, and Dr. Adami.

Chrome Purchases Near Stockpile Maximums

GOVERNMENT PURCHASES under the domestic chrome program are near an end, GSA's defense materials service has warned.

As of Feb. 7, only 10,562 long dry tons were still to be purchased at the Grants Pass, Ore., depot. And only 6,130 tons were still to be bought by the San Francisco office of GSA under the carload program. The two offices buy the bulk of the chrome purchased by the Government. When the remaining 16,000-odd tons are bought, they will have fulfilled their quota of 188,000 tons, set in 1951. Quota for the whole program is 200,000. An office in Seattle purchases some Alaskan output.

The San Francisco office noted that tonnages between Grants Pass and the carload program may be adjusted later on to close both offices at the same time. A public announcement will be made.

15-Million Ton Iron Ore Output Seen in Liberia

LIBERIAN MINING CO., with output from its Bomi Hills mine and from the proposed Cape Mount operation, 20 miles southwest of Bomi, is to be joined by a new 8,000 tons per hour property at Nimba, owned by Liberian American Swedish Minerals Co., for total annual output of some 15-million tons of iron ore.

Liberian Mining, now producing 2.5-million tons per year from Bomi and

This 240,000-pound steam drum, built by Combustion Engineering for a large generating plant, is here being hoisted 120 feet into position by strong wire rope. It's a striking example of how . . .

safety rides on quality wire rope

You may never hoist loads as large as this 120-ton drum. But *safe, top quality wire rope is just as important to your own operations.* For, although the price of a "bargain" rope would be less, failure of such a rope could cost you thousands of dollars in wrecked equipment. Don't be a victim of false economy. Buy a wire rope that's a quality rope—buy Wickwire Rope.

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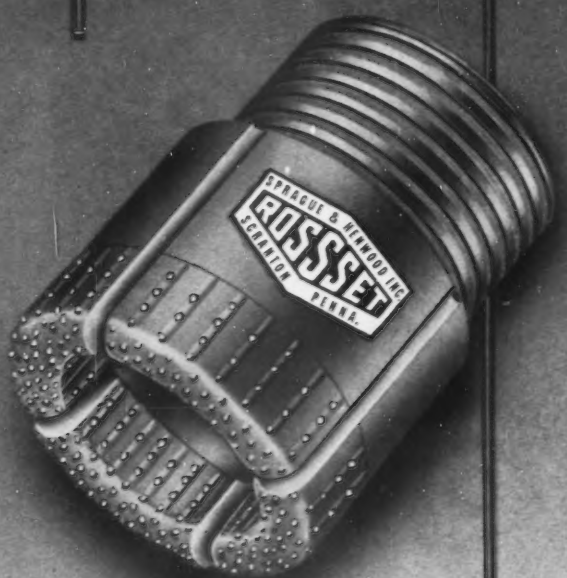

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Liberian Iron Ore *(Continued)*

stock-piling a vast amount of low grade, plans production from the new Cape Mount pit by 1959, with increase in tonnage to 7.5-million. At Bomi, a Bucyrus-Erie 150-B dragline is being added to the company's Caterpillars and Euclids to increase production.

At Nimba, operated by a consortium of Grangesbergsbolaget, Atlas Copco, Sentab and a British and an American firm, drilling and tunneling has reportedly proved enough ore to support another 7.5-million annual tons facility.

A 250-mile railroad will be built to the coast to handle the Nimba ore.

Three Firms Prospect Tin in Australia N. T.

POTENTIAL PRODUCTION of 500 tpd of tin ore is claimed for the Maranboy tin fields of Australia's Northern Territory by three large mining companies which have recently been granted prospecting rights over the area.

King Island Scheelite Ltd., United Uranium N.L. and Loloma Gold Mines have sunk one shaft to 170 ft on the way to a 250-ft bottom and drifted from it. A crosscut at 125 ft reportedly revealed 17 ft of 1.75% tin ore.

Maranboy had previously been worked only by individual operators working separate and small diggings.

Japan Creates Fusion

MEMBERS of the Japanese Academy of Science have announced successful achievement of nuclear fusion, following similar reports by Britain, France and U.S. (*E&MJ*, February 1958, p 47.) Temperatures conservatively estimated at 1-million deg were claimed by Dr. Yasuji Fushimi, chairman of the academy's Atomic Energy Committee, in a machine costing less than the British Zeta apparatus.

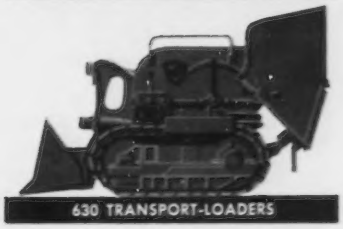
Antimony Committee Set

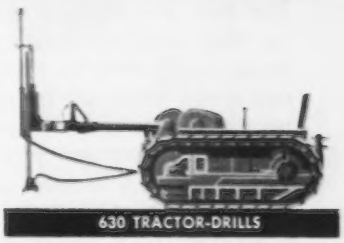
ORGANIZATION of the American Antimony Committee, a member of the Committee for a National Minerals Policy, has been announced in Hollywood, Calif. Latter organization was formed in September 1957 at the American Mining Congress. Officers of the antimony group include Alma D. Priester, chairman; Earl R. Pilgrim, vice-chairman; and C. B. Wells, secretary-treasurer.

Water Purification Plan Nears Commercial Usage

A "REVOLUTIONARY PROCESS" for purification of polluted streams, with potential vast use in extraction of salt from sea water, mineral separation and reclamation of re-usable wastes is nearing success, according to Dr. Lincoln R. Theismeyer, president of the Pulp and Paper Research Institute of Canada, Montreal.

By breaking the polluted water down into a fine spray, heating it and whirl-





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Eimco 630's with their many patented features provide unusual ruggedness and dependability that is exclusive with Eimco equipment.

Low operating and maintenance costs with high production and unequaled maneuverability make the 630 the preferred machine for underground trackless operation in rock headings and tunnels.

Hundreds of 630's in operation as excavators, bulldozers, transports and other variations have shown a lower cost per ton moved, transported or loaded than any previous equipment.

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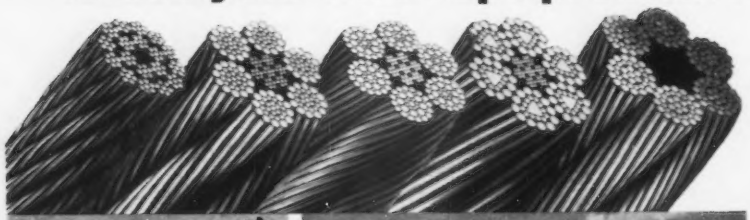
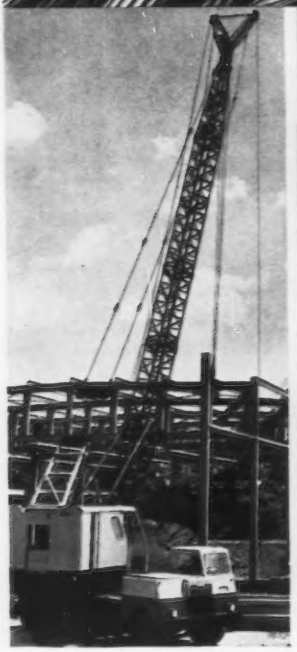
is this your wire rope problem?





Matching type or construction to the job is key to wire rope efficiency and economy.

FREE RED-STRAND BULLETIN NO. 107 TELLS HOW.

The ideal wire rope for guying a mast would go to pieces in jig time if used as a hoist rope. Similarly, the best rope for the latter would soon be ruined by bending fatigue if used on equipment which has too small sheaves or requires numerous reverse bends. How to coordinate wire rope and the job to insure maximum service life and operating efficiency in all such variations is very clearly told in Service Bulletin No. 107. Copies free on request. Write H. K. Porter Company, Inc., Leschen Wire Rope Division, 2727 Hamilton Ave., St. Louis 12, Missouri.

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H. K. PORTER COMPANY, INC.
LESCHEN WIRE ROPE DIVISION

Purification Plan *(Continued)*

ing it, the chemicals which poison it can be removed says Dr. Theismeyer.

He described the process as a major "technological breakthrough" with industrial applications far beyond the paper industry.

It has yet to be proved commercially, he emphasizes, but he is confident it will pass the test.

"It's one of those exciting processes that happen once in a lifetime," says Dr Theismeyer, a former American geology professor who first saw the inside of a paper mill when he came to Canada in 1950.

"We're getting close to commercialization," he says. "Engineering firms are working on the design of the first commercial plant."

It is expected to be used by a pulp plant in Wisconsin, possibly within a year.

The solids can be separated from the liquid after it has been atomized by a cyclone separator.

"Then the stream can be passed along as process steam in the plant or condensed and the water re-used," he explained.

With paper mill waste, combustible gases are drawn off with the chemicals to be saved, and are passed back into the outside jacket for burning to keep the process going.

The pilot plant at the institute here converts liquids by the gallon. Commercial plants would process "hundreds of tons a day."

He says the pulp and paper industry has spent $1-million developing the process during the last six years. The institute has Canadian patents on it and foreign patents are pending.

Metal Mines and Plants Cut Injury-Frequency

FREQUENCY OF INJURIES (fatal and nonfatal) in metal and nonmetal mines and processing plants were reduced in 1956 from 1955 totals, according to the U.S. Bureau of Mines.

Metal mines dropped their frequency rate from 44.39 in 1955 to 37.19; nonmetal mines from 39.45 to 38.72; plants, 19.07 to 15.79. Fatalities for all mineral industry groups, including coal and petroleum, increased in 1956, the Bureau said, but declined individually in metal and nonmetallic mines and metal mine plants.

Yugoslavs Plan Pit and Refinery for Majdenpek

YUGOSLAV AUTHORITIES have announced a planned output of 25,000 tons of copper from the Majdenpek deposits of Eastern Serbia following eight years of development surveys. A 12,000 tpd plant will process the ore and also extract 2,500 kg of gold and 40 tons silver per year.

Eight-year study involved some 10,000 meters of sinking and 18,000 meters

Now . . . a New High in Dust Filter Efficiency . . .

New SLY "ROLL-CLEAN" Dynaclone

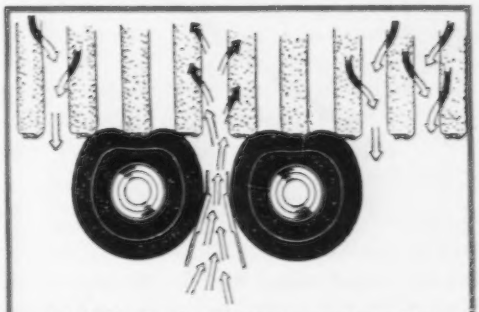
THESE NEW FIELD-PROVEN FEATURES

- Easier filter bag changing.
- Greater cloth area.
- Fewer operating parts.
- Free-rolling cleaner — no sliding.
- Complete dust seal — automatic seal adjustment.
- Easy access to all dust filter parts for inspection and servicing.

PLUS THESE TIME-TESTED DYNACLONE ADVANTAGES

- Constant suction at dust sources — complete dust collection.
- Self-cleaning for continuous operation.
- No auxiliary motors or blowers required for filter-bag cleaning.
- Greater filtering capacity and smaller space requirements — more cloth per cubic foot of filter than any other make.
- Lower power requirements.

The original self-cleaning dust filter, the Dynaclone has proven itself the most efficient dust filter ever made. The "Roll-Clean" Dynaclone combines design simplicity and rugged construction to insure even greater operating efficiency . . . even longer trouble-free service.



NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.

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36-page Bulletin 104 gives full details about "Roll-Clean" Dynaclone and other Sly Filters . . . contains valuable engineering information. Write for copy.

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Yugoslav Refinery *(Continued)*

of drifting. Last summer, Belgian and French interests guaranteed $40-million credit to the Majdenpek development. Completion date is 1961 for the open pit operation.

A refinery capable of handling the 25,000-ton output of the new mine and the 30,000 tons now produced at the famous Bor mine, to the south, will be constructed at the latter site. New complex will also double Yugoslav selenium output, official sources said.

U. S. Uranium Producers Meet 10,000-Ton Plateau

ATTAINMENT of an annual domestic production rate of 10,000 tons of U_3O_8 has been announced by AEC. Concentrates received by the Commission totaled 8,640 in calendar 1957, including 146 tons produced as phosphate rock by-product in Florida, as euxenite by-product in Idaho, and reprocessing of refinery residues at Vitro Corp.'s Canonsburg, Pa. plant.

Foreign sources supplied 11,826 tons for a total receipt of 20,466. (AEC notes that December foreign totals are estimated.)

IN THE U. S.

ALASKA

Litigation over the Yakobi Island nickel deposits is apparently over. The First Division District Court has issued a judgment recognizing an out-of-court agreement, and the way is now open for exploration work to proceed. It has been indicated that drilling will be started in the approaching season, according to the Territory Department of Mines.

ARIZONA

Miner layoffs and shorter work weeks have nipped $11.5-million annually from the state's payroll.

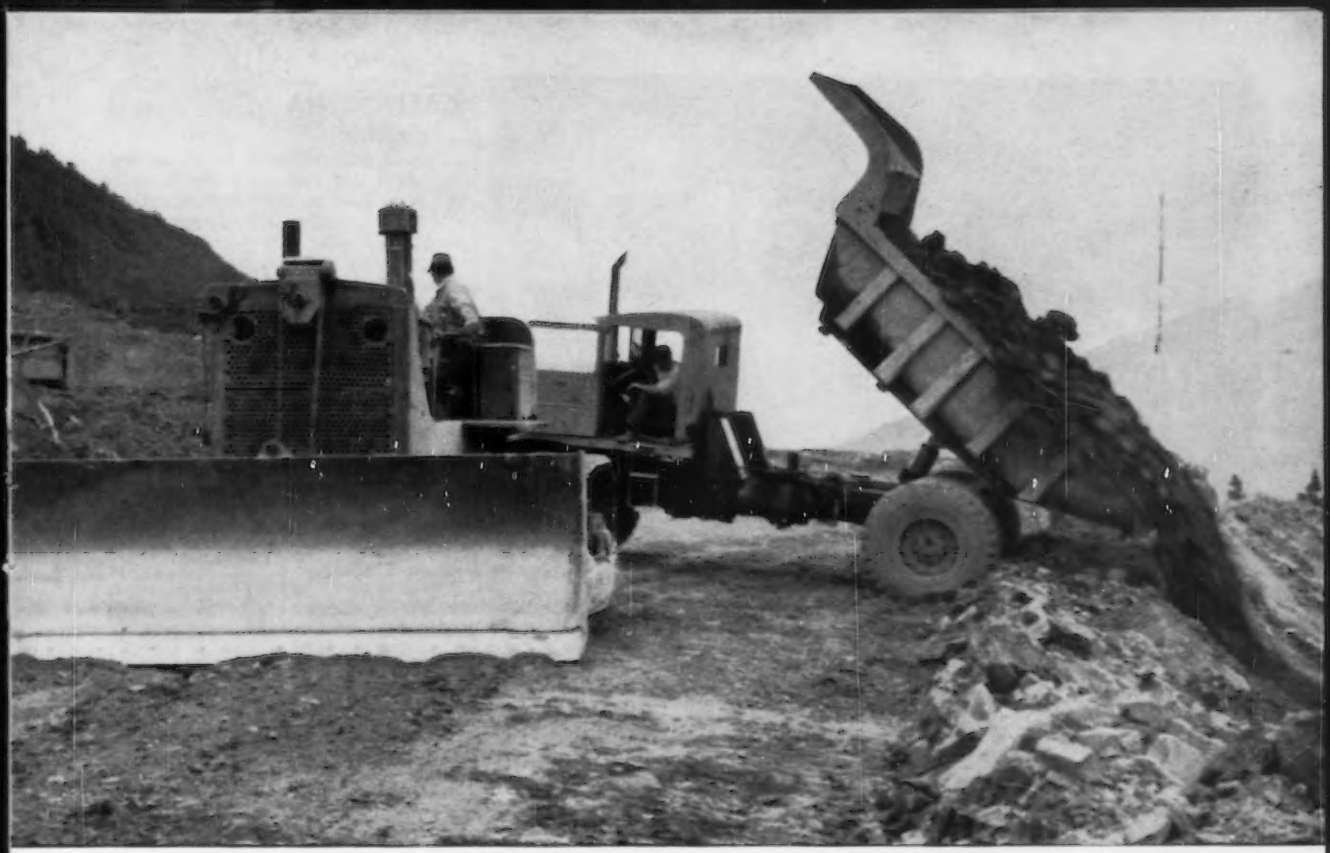
Most of the declining mine economy is in the Clifton-Morenci, Bisbee-Douglas, Ray-Hayden, Globe-Miami, and Ajo districts.

The reduction came on heels of news from the Arizona Copper Tariff Board that the state's gross mine income dropped more than $122-million last year as compared with the gross of 1956.

At year end there were 700 fewer miners employed than at the start of 1957 with the average weekly payroll 13,900 miners and 1,800 smelter workers.

The total Arizona reduction now amounts to 22% since 1956.

Total value of the state's copper production dropped from $430,021,000 in 1956 to $300-million in 1957—despite a record production of 510,000 tons during 1957.



The dozers, trucks and shovels used at this strip mine in Alaska are made from High Strength Steel. They work all winter in sub-zero weather and even in the summer must dig through permanently frozen ground.

USS High Strength Steel rips through rock at 30 degrees below zero!

Edwards, Nesmith, Ryder, Inc. operates a strip mine in Alaska. It's a hundred miles into the bush and it often takes a year to get heavy replacement parts there. But they haven't had a shutdown since they started in 1953. Why? Their shovels, dozers and trucks are made from High Strength Steel.

Says President and Business Manager Wesley Edwards, "Our equipment has to work every month of the year, and we dig ground that's frozen solid a foot below the surface even in summer. During the winter we have an extra problem—the temperature goes down to 30 degrees below zero. When it's that cold and you have to rip through this sandstone and bone seam, you can crack steel blades pretty easily.

"But, we've had no trouble at all with our equipment made of High Strength Steel. It has actually cut through a mountain of ice and rock to open the sixty-foot vein we're working now."

High Strength Steel handled this job because it's stronger and tougher than structural carbon steel which is still being used in some earthmoving equipment. High Strength Steel has a yield point 50% higher than that of structural carbon steel and it has more resistance to wear, impact, abrasion and atmospheric corrosion.

United States Steel produces three brands of High Strength Steel—COR-TEN Steel, MAN-TEN Steel and TRI-TEN Steel. Each has a specific combination of characteristics that is best for certain jobs.

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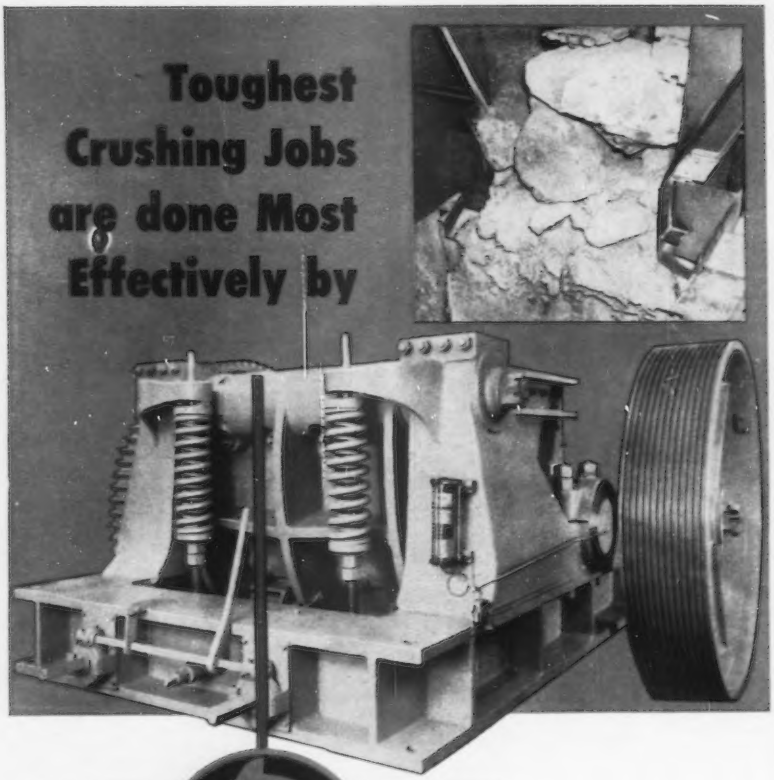

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CALIFORNIA

GSA's Defense Materials Service is buying about 110 carloads a month under the manganese carload program through the Region 9 office in San Francisco, a spokesman said.

Manganese ore sinter from the Mojave Mining & Milling Co. mill at Wickenburg, Ariz, accounts for most of the volume.

In addition, several small producers in Southern California are shipping unsintered ore to the DMS.

The Region 9 office serves California, Arizona and Nevada.

Utah Construction Co, San Francisco-based firm with world-wide activities in the mining and heavy construction fields, reports 1957 was its best year.

Company's earnings, together with its share of profits of subsidiaries and affiliates, reached $5,422,000, highest in its 57-year history. That figure—representing net overall earnings after tax for fiscal year ended Oct. 31—compares with $4,178,000 the previous year.

President Allen D. Christensen attributed its records set in 1956 and 1957 to the "general high level of world business activity which favored the company's mining and construction activities."

New mining properties, including the Lucky Mc uranium mill in Wyoming, in which it has an interest, are expected to augment 1958 earnings. However, construction activity was down at end of the year.

Kaiser Steel Corp. has cut work week at its Eagle Mountain, Calif, iron mine to four days and trimmed 45 men from the 365-man work force.

The moves were necessary because the firm's steel mill at Fontana—which the iron mine supplies—is being operated at only 78% of capacity.

Gil Embree of Kernville is reported planning to locate a 300-to-400 tpd barite mill in Bakersfield to process extensive surface deposits at claims north of Kernville. Reliable reports indicate an expenditure of $150,000 to $200,000 is contemplated on the Bakersfield mill, final plans for which will be made within 60 to 90 days, it is said.

Embree plans to sack as well as process the material in Bakersfield. Plans for flow lines are on the drawing board now. An 18x36 double jaw would bring material down to approximately 2 in. Final decisions about machinery for further crushing are pending, it is reported. The Bakersfield plant will be largely automatic, employing three men plus loaders, it is estimated.

Placer mining in the Black Gulch area of the Kern River was banned in a decision handed down by John A. Wood, hearing examiner for the Bureau of Land Management, at Sacramento recently. The decision concerns the Diablo Placer Group mining claims totalling 160 acres in the vicinity of the Borel Powerhouse. The claims are owned by eight persons represented by Dr. Ralph

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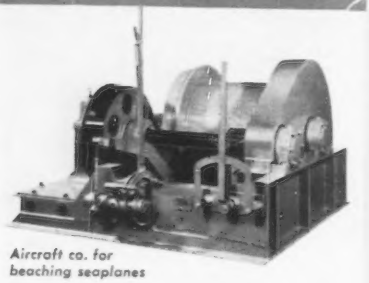
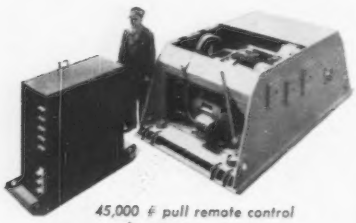
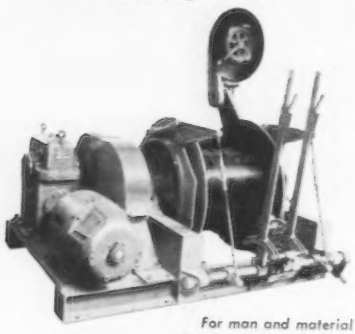


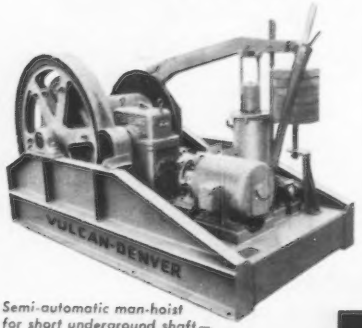
Aircraft co. for beaching seaplanes



45,000 # pull remote control car dumping



For man and material interior shaft installation



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California *(Continued)*

Sir' Kegian, a Los Angeles chiropractor, according to information presented at the hearing.

U. S. Forest Service led opposition to plans for placer mining at a previous hearing in Bakersfield. Kern County sportsmen supported the Forest Service stand. It was pointed out that the placer site was the same area proposed for recreation development by the Forest Service.

Sir' Kegian may appeal the decision to the director of the Bureau of Land Management, Wood's decision said.

COLORADO

Annual report to shareholders of Golden Cycle Corp., headed by Merrill E. Shoup, Colorado Springs, gives insight on how producers of uranium ore are having to adjust their operations in view of new concentrates procurement program of the Atomic Energy Commission.

The firm operates uranium properties in Utah, South Dakota, Wyoming and Colorado.

At its Black Bear, Marysvale, Utah, properties, Golden Cycle has engaged in a "drastic cut" in uranium ore production because of re-adjustment of schedules at the Salt Lake mill of Vitro Uranium Co, a division of Vitro Corporation of America.

"Our quota assigned was drastically low" because of lack of production history at Marysvale, Mr. Shoup said.

"We first were assigned a quota of 1,000 tons a month, a few weeks later this was reduced to 500 tons a month and then to 300 tons a month which is now our quota until further notice," he said.

"As a result of this action, we have been forced to make a drastic cut in our operations and are mining as high grade ore as possible to insure continuance on a very limited basis, hoping our quota will be increased in the near future.

In its joint operations in Wyoming and South Dakota with Giant Resources, Inc., Golden Cycle also is facing probable cut-backs in shipments to the Edgemont mill.

He said shippers to the mill were advised in late December that a mill cutback had been imposed by AEC and that quotas were in the process of being assigned.

This is "highly important to us, since we have developed a sizeable tonnage of medium to low grade ore which must be produced at a fast rate to make the operation profitable," Mr. Shoup siad.

While some properties may be acquired in this area, Golden Cycle said it feels it is "not justified in acquiring properties (generally) until it is assured of a ready market for our ores."

"It is believed that the restrictions on 'yellow cake' production by mills may be lessened in the near future; but since this is conjecture only, the management is not making any large financial commitments to acquire additional production at this time," he said.

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Colorado *(Continued)*

Atomic Energy Commission in Washington, D.C. has held that its contract with Atomic Fuels Extraction Co., Salt Lake City for construction of a 250 tpd uranium mill at Bedrock has expired

The contract, signed in 1956, had been extended on at least one occasion as the firm sought to qualify with AEC on its financing.

John R. Black, Pocatello, Ida., attorney who is counsel and secretary for the company headed by Jack Turner of Moab and Salt Lake, says the firm has met these qualifications.

Tom Slick, San Antonio, Tex., a founder of Slick Airways, air cargo haulers, has informed AEC of his support of the project, Mr. Black said.

The attorney said he had filed a protest to the Washington decision under the Administrative Procedures Act.

In contracts executed in 1957, the DMEA assisted Colorado mining concerns and individuals to the extent of $766,347, according to the Bureau of Mines preliminary report for 1957. These projects, in which the Government participation was 75% of the total contract for thorium and uranium and 50% for copper-lead and lead-zinc-copper, were located in nine different Colorado counties and were as follows:

Custer county, the Cotter Corp. for thorium on the Star and other claims $18,876.

Fremont county, Cunac Minerals, Inc. for thorium on the Pink Lady and other claims, $20,760.

Jefferson county, Arthur I. Cervi, for uranium, on the Cervi lease, $17,536; Caleb V. Haynes, Jr. for uranium on the Black Knight and Billikin lodes, $20,256; Uranium Enterprises, for uranium on the Mann No. 1 mine, $11,700.

Mesa county, Lisbon Uranium Corp. for uranium on the John Brown and other claims, $45,572; New Idria Mining & Chemical Co. for uranium on the Johnnie May group of claims, $53,444.

Montrose and San Juan county, Strategic Minerals Exploration Co. for uranium, on the Joan, Ray and Elle claims, $6,750.

Park county, Leadville Lead and Uranium Corp. at the Hilltop Mine, for lead-zinc-copper, $99,418.

Rio Grande county, General Minerals Corp. for copper-lead at the Summitville Mine, $149,380.

Saguache county, D&J Uranium and Exploration Co. for uranium on the Conita and other claims, $44,800, Universal Metals Co. for uranium on the Friendly Neighbor and Sage Hen group, $29,475.

San Miguel county, Climax Uranium Co. for uranium on the D.V. & Vanderwalker claim groups, $248,380.

The year 1957 was successful for Climax Molybdenum in many respects, according to Edwin Eisenach, general superintendent of the mine located at Climax. The mine, listed as the world's largest underground mine, produced approximately 43-million lb of contained molybdenum from an average produc-

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Colorado (*Continued*)

tion of approximately 34,000 tpd. Production figure exceeds the 1956 production by nearly .75 million tons.

Eisenach said that general improvements in mill procedures and facilities and wider production areas, were the key factors which enabled Climax to register this record production year. In commenting on the outlook for the future, Eisenach said that Climax has learned to economically process lower grade ores and this will lead to an increase in the molybdenum reserves for future years.

Climax plans to continue its mine preparation program at a steady pace this year, according to Eisenach. He announced that included in this program will be the sinking of a 19 ft dia circular shaft to the 1,000 ft level which will further expedite the Climax exploration and development program. New shaft should be completed by the latter part of the year.

United Western Minerals of Santa Fe N.M. is presently involved in surveying and drilling land on which it has staked claims or has leased in the Tallahassee district northwest of Canon City. Marvin Chase, manager of the Canon City office, says UWM has claims or leases on about 150,000 acres in the area from Tallahassee to Hartsel, where the company is engaged in uranium exploration. UWM has staked approximately 2,500 claims. The large area includes private land, state leases and federal lode mining claims.

The company is now employing about 25 under the Canon City office. UWM opened the office in Canon City two months ago and also moved its office from Westcliffe to here. Other holdings in this area include about 13,000 acres in the Sangre De Cristo range west of Westcliffe.

New Jersey Zinc Co., Empire Zinc Division, at Gilman, continued operations throughout 1957 on a full production basis. Operations were conducted on a three shift schedule with an average employment of some 500 people.

Zinc production at Gilman was maintained in spite of falling zinc prices resulting from foreign zinc imports and curtailment of the Governmental stockpiling program. Approximately 4,400 tons of zinc concentrates, 700 tons of lead concentrates and 1,800 tons of copper-silver ore were produced each month. Development continued through most of the year and included the driving of a new incline from 24 to 25 levels and the partial development of 25 level.

A score of employees of the Great Lakes Carbon perlite plant in Florence received notice that plant operations would be terminated, by injunction and damage suits filed against Great Lakes by a group of residents living in the city's east end. The announcements of the plant's unexpected closing date will nullify the injunction action but still pending against the company are damage suits totaling $102,000 filed by 19 local property owners. Both injunction and damage suits were filed because of waste dust from the plant falling on property in adjacent areas.

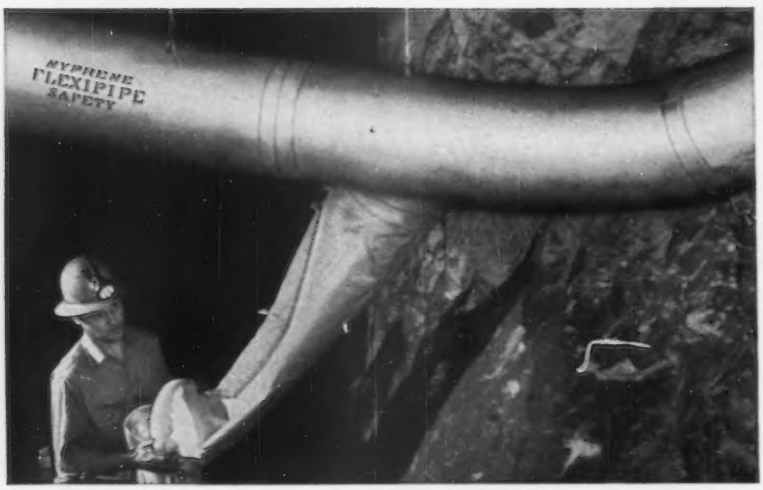
Great Lakes had announced that local operations would be suspended in mid-1958 and key Florence plant equipment moved to Antonito, where a new and larger plant is now being constructed.

Strikes of uranium ore by the Globe Hill Mining Co. of Colorado Springs and the Trans-Mountain Uranium Co. of Denver have been reported. Harold Anderson, president of the Globe Hill Co. stated that his company's last shipment to the Union Carbide Nuclear mill at Rifle assayed 0.49% uranium. The Globe Hill-Trans-Mountain mining is being done six miles north of Cripple Creek and is a stripping operation. Anderson said gold also is being found but the companies have been mainly interested in uranium because the strike has been so rich.

Anderson said that another shipment of ore has just been sent to Rifle and is expected to equal the 0.49% ore previously shipped. As the average uranium ore being milled in this country contains only about 0.25% uranium oxide, this rich material showing in the Cripple Creek region is said to be causing a sensation.

Several discoveries are rumored to have been made by companies with head-

THE BIGGEST NEWS IN MINE VENTILATION TUBING . . .



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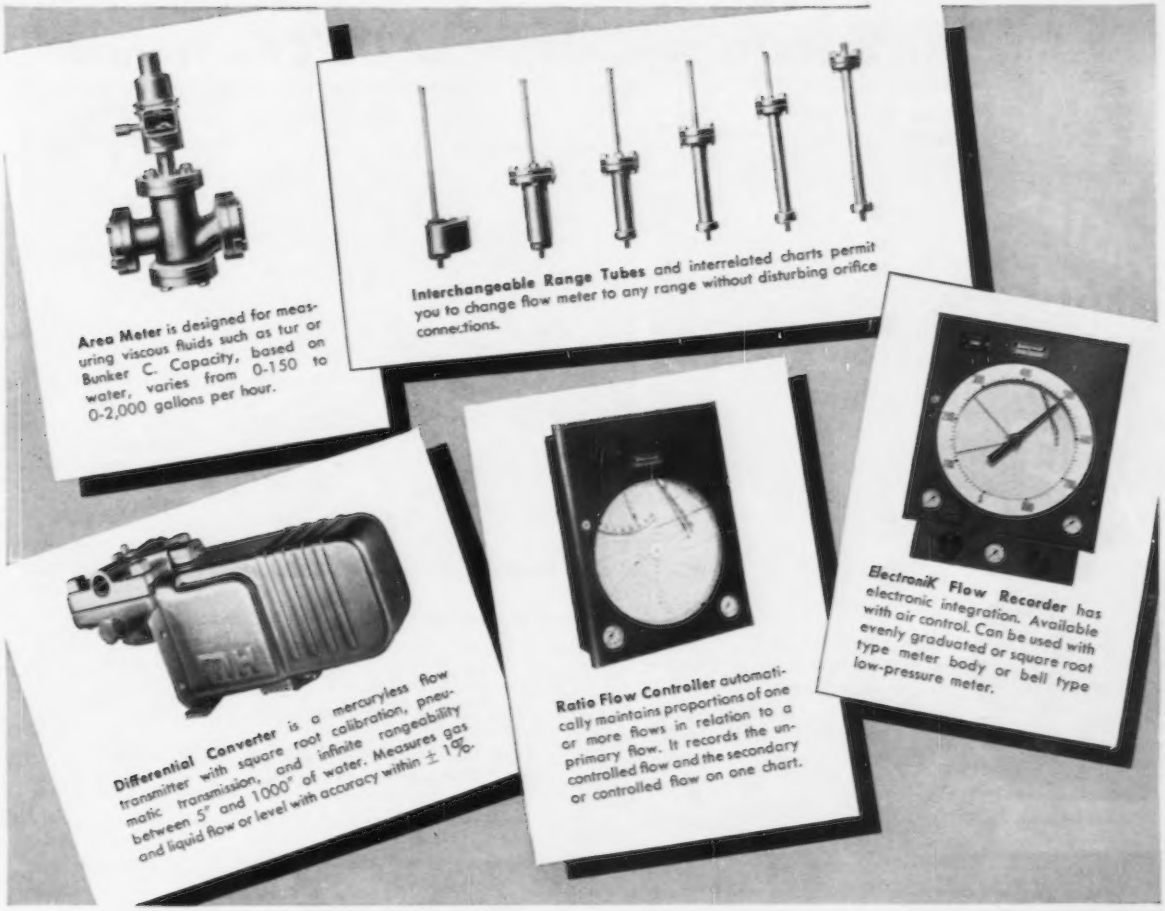
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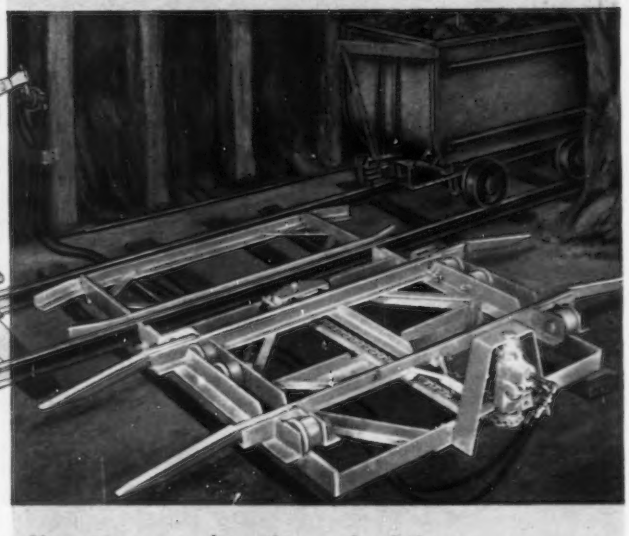

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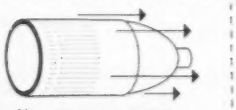

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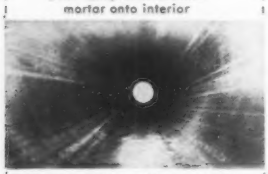

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Colorado *(Continued)*

quarters in Dallas, Texas, and Grand Junction, Colo. Anderson reports that prospectors have been trudging through snow 3-ft deep trying to locate uranium ore and that "4x4's are springing up everywhere."

Colorado's output of silver, copper, lead and zinc were greater but gold less in 1957 than in 1956, reports the U S Bureau of Mines. The combined value of the five metals declined to $25.4-million from $26.3-million in 1956. This decrease in value resulted from drops in the unit prices of copper, lead and zinc.

Four Star Exploration Co. Inc. of Canon City, reports completion of surface installations on its leased property in the Texas Creek area of Fremont county. "Mining operations in the shaft have been going along smoothly and ore showings have improved" says company president, Mike M Adragna. He says that ore taken from the vein has improved to give a radiometric of 4%.

Adragna reports that a new vein heading northeasterly has been crossed in the shaft and plans are being made for new drill holes along the strike of this vein; that an extensive program of close-order drilling has been completed and final results of the drilling are now being checked.

IDAHO

Coeur d'Alene District operations of the big Bunker Hill Co. were cut back to a four-day week at the beginning of February in an effort to meet the problem of reduced lead-zinc sales and mounting stocks brought about by excessive imports of foreign metals. Affected by the curtailment are the Bunker Hill and Crescent mines, the concentrator plant and mine plant services, including the sawmill and garage. The Star mine at Burke, which is operated by Hecla Mining Co. for Bunker Hill, has also gone on a four-day basis, as has Pend Oreille Mines & Metals Co., a Bunker Hill affiliate, which operates a big zinc-lead mine in the Metaline District of northeastern Washington.

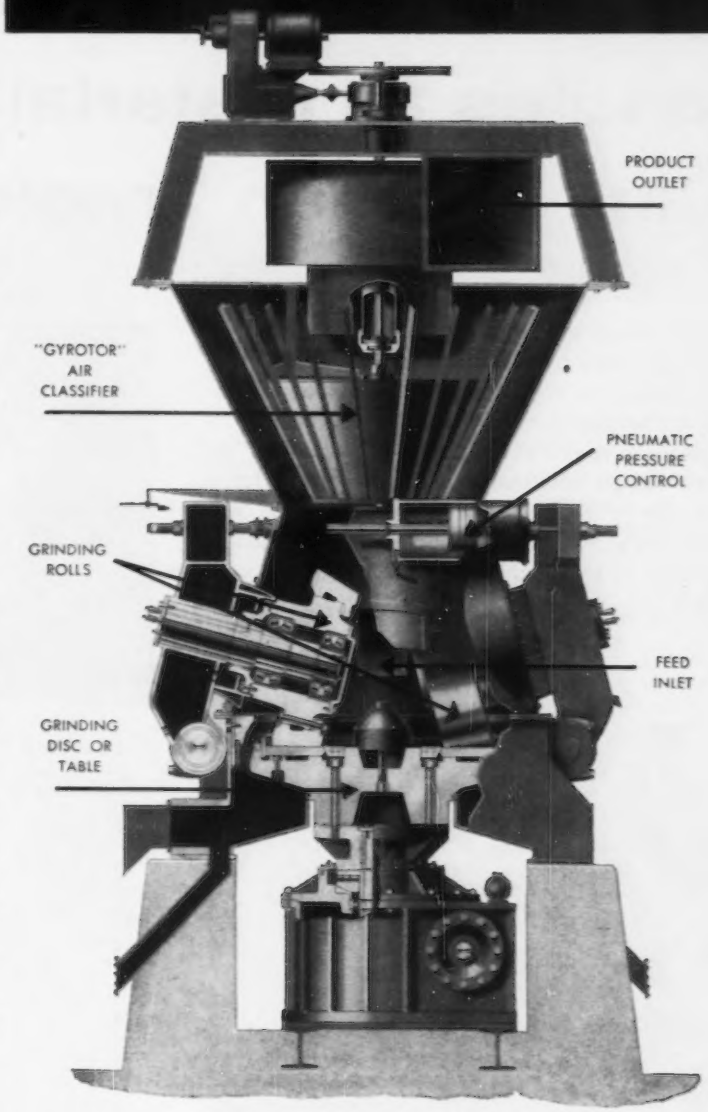
Company officials said the action was taken "reluctantly" and expressed the hope that it would be a temporary condition.

Schedules at the lead smelter and at the electrolytic zinc plant in Kellogg will be unchanged for the time being. Employees at these operations have been on a five-day week for some time.

Bunker Hill is the Coeur d'Alene District's largest employer by a large margin, with a current payroll well in excess of 2,000. The Star Mine has been employing a crew of about 370.

Black Bear Silver-Lead Mines Co. has located and is exploring what is believed to be the easterly extension of a vein which yielded considerable production where mined to the west by the Hull lease in previous years. The vein was recently leased by the Black Bear firm

DISC-ROLL MILL



The Hardinge Disc-Roll Mill is a roller-type mill with two adjustable, pneumatically loaded rolls for grinding material on a horizontal rotating disc or table (Loesche type). The Hardinge "Gyrotor" Air Classifier, in combination with the mill, provides a complete grinding, classifying, and drying system. A full description is given in Bulletin 52-1.

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Over-specialized equipment hiking costs?

READ HOW ANACONDA handles all material fast with Michigan Tractor Shovels

Most ore mined by the world-famed Anaconda Company at Butte, Montana, is smelted by the Anaconda Reduction Works in nearby Anaconda. From a pioneer beginning, nearly 75 years ago, this smelter has grown to be one of the largest in the world. This growth reflects Anaconda's unceasing search for a *better* way at *lower* cost in *less* time. Typical was their recent shift from slow single-purpose handling equipment to two highly mobile Michigan Tractor Shovels.

Transports material weighing 5,400 lbs per cu yd

These rugged versatile 2¾ yard Model 175A's "run" at 27 mph speeds all around the big plant to handle a wide variety of loading tasks. Hard-to-handle chunks of ferro-manganese—*weighing 200 pounds per cubic foot* —are the heaviest tractor-shovel work on hand.

One of the Michigans usually does the entire job. In a few hours it moves weekly requirements of 100 tons 750 feet from plant stockpile to massive timber storage platform. Planetary wheel drive axles, torque converter take up shocks of this rugged work.

Outworks a crane— with half the manpower

Planetary axles and the efficient all-Clark power train help out on another tough job—truck-loading "purification cake"—a sludge from the smelting process, rich in metals such as gold and silver. With a crane, it used to take 12 hours (and a 2-man crew) to load 240 tons; one Michigan now does the *same* job in *six* hours—with only one man! Operators like the fast reverse and power-shifting of the Michigan . . . management is pleased with the time and labor saved.

Goes in to load where trucks don't dare

Millions of cubic feet of calcine—iron oxide powder —are stockpiled here; it's used to make sponge iron for

treating copper ore in the flotation process. But on the ground it's a mountain of soft, treacherous dust. Trucks sink deep into the soft footing, so the big-tire four-wheel-drive Michigans go in alone, rush heaping buckets back out. A single Michigan keeps three five-yard trucks busy on a half-mile haul, heaps up to 80 truck loads in a day!

Spots and loads 12 rail cars in 5 hours

Anaconda's two Michigan 175A's spend roughly 30% of their time loading stockpiled crushed limestone. They move empty rail cars into position at the quarry, then fill them up. Loads run about 60 tons per car; each Michigan can fill a dozen cars in only five hours! Off-time jobs include stripping dirt; cleaning haul roads and around conveyors; helping trucks up steep grades; and removing tons of ash from the flue of the smelter stack.

In 8 hours, digs 80 foot trench through rocky soil

Despite busy schedules moving various stockpiled materials, the Michigans find time to do lots of odd jobs, too. Here, a Michigan digs its way through sun-baked earth and rock, excavating the trench for a concrete tunnel to hold electrical conduit. The trench is eight feet deep, ten feet wide, 80 feet long. How long did it take? *Only one 8-hour day*—and this includes piling waste material 100 feet away! The secret is a *full bucket* loaded and delivered every pass, a "trademark" of all Michigans. Unexcelled breakout force, low-level-tipback and low-level-carry also help deliver those bigger loads.

Which of these will fill the bill for you?

Model 12B:
6, 10, 16 (std), 20 or 27 cubic *foot* buckets
Models 75A, 75B, 75R:
¾, 1¼ (std), or 1½ *yard* buckets
Model 125A:
2 (std), or 2¾ *yard* buckets
Model 175A:
1⅜, 2, 2¾ (std), 3 or 5 *yard* buckets
Model 275A:
4 *yard* (std) bucket
Model 375A:
6 *yard* (std) bucket

For help in determining which of these eight models and how many of their 37 different buckets and attachments, will do an Anaconda-class job for you, let one of our Job Study Engineers study your layout. A card or a call will bring him. No obligation, of course—but we believe you'll find his suggestions worth further study!

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UPGRADER at Green River, Utah is one of the "front ends" of UCC's uranium plant.

Union Carbide Starts Its "Rifle Complex"

UNION CARBIDE NUCLEAR is completing shakedown runs of its two chemical up-graders at Green River, Utah, and Slick Rock, Colo.—a part of the so-called $8-million "Rifle Complex."

The up-graders, rated at ore input of 400 tons each, are described largely as the "front ends" of a convention uranium mill. Erected for Union Carbide by Catalytic Construction Corp. of Philadelphia, Pa., the units will take .3% to 15% U_3O_8, with resultant "con centrate" moving to the new Rifle, Colo., mill for further processing into 90-plus U_3O_8.

The Green River unit will operate on ore produced in the Green River-Temple Mountain area. Plant at Slick Rock will utilize ores from the Uravan mineral belt.

Shipments from Slick Rock will be by truck. Those from Green River by Denver & Rio Grande Western Railroad to Rifle.

Some 45 men, including camp employes, are employed at Slick Rock, where mill superintendent is J. P. Sanders. Mill head at Green River is D. M. Pembridge, both were formerly supervisors at the old Rifle mill, which is being abandoned. About 35 men will be employed at Green River, where camp facilities are not needed.

Union Carbide Nuclear describes the two up-graders as both "chemical and mechanical." However, the industry regards them as the only full-scale chemical up-graders ever approved for the domestic uranium business by the Atomic Energy Commission. Vanadium Corporation of America has the only major mechanical up-grader at its Monument Valley, Ariz. mine properties.

Union Carbide Nuclear has not released details of the metallurgy at either the up-graders or the new Rifle plant.

Construction of the up-graders was under supervision of Thomas Holmes, Green River, Catalytic Construction engineer.

Union Carbide moved its buying station and sampler from Thompson, Grand County, Utah, to Green River in connection with commencement of operations at the new up-grading facility on the Green River.

Idaho *(Continued)*

found in the Grover Cleveland claim, from American Smelting and Refining Co. Drift work is now in progress to determine if the ore shoot extends beyond the fault which cut it off in the Hull lease workings.

Bunker Hill Co.'s new northwesterly exploration tunnel has entered that part of the Senator Stewart area in which Silver Bowl, Inc., has a 25% participating interest and is now being extended westerly "on line" to explore for the downward projection of orebodies which produced substantial tonnages of high-grade lead-silver ore from upper workings in the early days of the district.

A promising new silver ore strike has been reported by Federal Uranium Corp. on the property of Conjecture Mines Inc. in the Lakeview District of Bonner County. The discovery was made at the 45-ft point in a 175-ft drill hole put into the wall of an old tunnel on the Silver Leaf group of claims. Sludge from the drilling showed silver values of nearly 50 oz per ton.

In the Conjecture Mine, drifting on the new 700-ft shaft level has opened the downward extension of two ore shoots and both are reported to be longer, wider and richer than on the 500 level above.

Since negotiating an operating agreement covering the properties of Idaho Lakeview Mining Co. recently, Federal Uranium has had operating control of about 85% of the properties in the Lakeview District.

Idaho Custer Silver-Lead Mines Inc. has informed its shareholders that two "very encouraging" ore structures were disclosed by diamond drilling at its Livingston property in Custer County just prior to the winter shutdown last December. One down-hole southwest of the shaft penetrated 9.3 ft ore that averaged 9.4% zinc and nearly 1 oz silver per ton between 110 and 120 ft below the 2500 level. Another 48-deg down-hole south of the shaft cut 10 ft of good lead ore between 50 and 60 ft below 2500. The lower 5 ft of this ore zone assayed 9.7% lead, 8% zinc and 7.6 oz silver to the ton.

Development work at the property is to be resumed in the spring as soon as snow conditions permit. Operating company on the project is Hecla Mining Co.

All major installations of gas equipment at the Bunker Hill Co.'s Kellogg plants are expected to be completed by the first of February. Included in the program to convert to natural gas from other types of fuel have been all kettles at the lead smelter, the smelter vacuum dezincer, the silver refinery retort, melting equipment in the zinc plant, residue dryers in the zinc plant leach department, and main boilers for the mine and zinc plant, as well as the smelter auxiliary boiler.

Northwest Prospecting and Development Co. of Spokane, operator of a thorium property on Hall Mountain in northern Boundary County, has received an offer from Heavy Minerals Inc. of Chattanooga, Tenn., to buy 100,000 lb of thorium oxide for 1958 delivery, according to president C. W. Greear. An initial shipment of concentrates from the mine last October has shown that the material is readily amenable to the process used by the Tennessee firm. The purchase offer specified that concentrates would have to contain at least 20% thorium oxide.

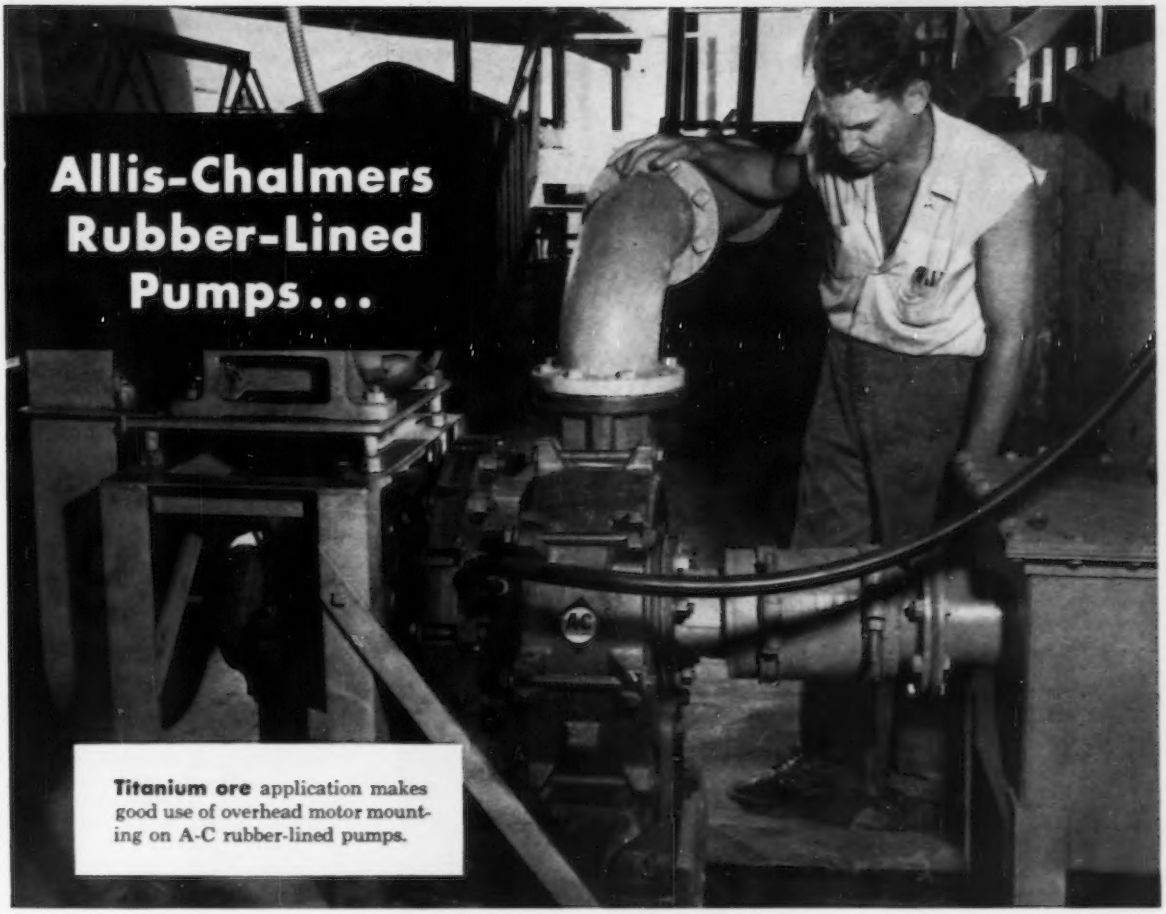
Bunker Hill Co. reported annual sales of $56,467,000 for 1957 compared to $57,068,000 in 1956. Earnings for 1957 are $1,158,000, compared to $3,020,000. These preliminary figures are subject to year-end audit.

John D. Bradley, president of the lead-zinc company, explained that the sharp decline in earnings was primarily a result of the low metal prices effective during most of 1957. Part of the decline, he said, was attributed to application of accelerated depreciation methods to the increased capital expansion program. Depreciation charges amounted to $1.71 for 1957.

The Bunker Hill president said the physical condition of the Company continued to improve. "In fact, the ore reserves at the Bunker Hill mine at Kellogg, Idaho are the greatest in history. Development at the nearby Crescent mine, historically an important silver-copper-lead producer, is continuing with encouraging results."

Bradley emphasized that Bunker Hill continued to be a strong advocate and active participant in the world-wide research program to discover new uses for lead and zinc. He said the long-range picture for them continues to be good.

Southerly diamond drilling by Polaris Mining Co. from its 3,000-ft-deep East lateral beneath Rainbow Mining & Milling Co. property in the Coeur d'Alene District silver belt west of Wallace has disclosed the presence of rich silver veins between 550 and 650 ft south of the main lateral. The first drill hole encountered a 5-ft width of 46-oz silver ore at 560 ft and a 4-ft width of 53-oz ore



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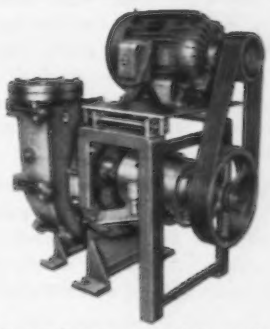

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Idaho *(Continued)*

at 621 ft. Another hole some 250 ft to the east cut ore comparable in grade at the 600 ft point and was being extended to probe for the second vein structure at the time of this writing.

A south crosscut from the lateral is now in progress and is expected to reach the vein structures in about 2½ months.

The Rainbow property is adjoined on the east by Vulcan Silver-Lead Corp.'s Galena Mine which American Smelting and Refining Co., with Day Mines Inc. as a 25% participating partner, has developed into one of the district's leading silver producers in recent years.

The Polaris East lateral, started over 4 years ago from the 3,000-ft level of the Silver Summit shaft under a DMEA contract, has been extended considerably more than 2 miles to date, but the present face is still some 1,400 ft from the east boundary of Rainbow ground.

Old Continental Mining Co. has been organized by Coeur d'Alene and Spokane, Wash., interests to operate the old Idaho Continental lead-silver mine in northern Boundary County, just south of the Canadian border. The property, located about 30 miles west of Porthill, has been worked intermittently since its discovery in 1884 and now has about 3 miles of underground tunnels. Last year the new operators installed about $60,000 worth of new equipment, including a new ore-crushing plant, and they shipped a small amount of lead-silver concentrates to the Bunker Hill smelter at Kellogg.

MINNESOTA

There were three producing mines on the Vermilion range in 1957: the Soudan and Pioneer of Oliver Iron Mining Division and the Zenith of Pickands, Mather & Co.

Snyder Mining Co. shipped a total of 1,023,304 tons in 1957 from three Mesabi range mines: the Webb, Whiteside and Godfrey. The Godfrey is an underground mine leased from the Oliver and 1957 was its first year of shipping after being reopened by the Snyder Co. It produced 226,776 tons as compared to its last full year when operated by the Oliver of 287,901 tons. The mine has produced nearly 10½-million tons since its opening in 1926. In addition to operating the Godfrey, the Snyder Mining Co. is conducting stripping operations at its Webb and Whiteside mines, at Hibbing and Buhl. The Godfrey is located between Hibbing and Chisholm.

Reserve Mining Co.'s taconite plant at Silver Bay is turning out about one-third more tonnage than was estimated: over 5-million tons in 1957 instead of its rated 3,750,000 tons. It produced its 10-millionth ton of pellets in November 1957. Oliver Iron Mining's Pilotac plant at Mountain Iron produced about 750,000 tons from its 500,000 tons rated capacity of pellets.

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Minnesota *(Continued)*

Fred De Vaney, Duluth, director of metallurgy and research for Pickands, Mather & Co., predicts that plants for the concentration of non-magnetic taconite will be in operation on the west Mesabi range within 15 years. He also believes that within 25 years 40,000 to 50,000 tons of taconite concentrates will be produced annually in the Lake Superior district.

Erie Mining Co. is installing a duplicate of its original 60-in primary crusher and four 36-in crushers with a conveyor to the fine crushing plant. This will serve as a standby facility and also add to the plant's capacity when needed.

Jones & Laughlin Steel Corp.'s Minnesota Ore Division shipped 2,641,326 tons from seven Mesabi range properties last season. The Columbia mine at Virginia was its largest producer with 714,604 tons. The Hill-Annex at Calumet was second with 655,147 tons, bringing the mine's total shipments in 40 years to 51,116,974 tons with about 3¼-million tons remaining. The Hill's best years were 1941 when it produced 3,645,950 tons and 1942 when its shipments were 3,477,560 tons.

Republic Steel Corp. produced from two Lake Superior area mines in 1957: The Susquehanna at Hibbing, Mesabi range, 604,330 tons; and the Tobin at Crystal Falls, Michigan, Menominee range, 144,085 tons. The Tobin, which made its first shipment in 1901 and was closed down in October 1957, is nearly exhausted.

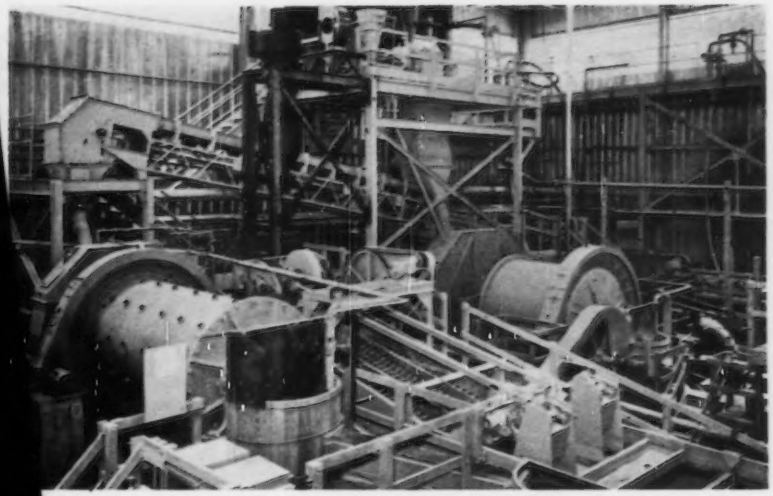
Pacific Isle Mining Co. in 1957 shipped ore from 28 properties, from all three Minnesota ranges and two Michigan ranges—the Gogebic and Menominee. Total shipments from Pacific Isle operated mines were 1,564,211 tons of which 190,184 tons came from Michigan mines. Among the mines operated by the company for the first year were: the Iroquois at Mountain Iron, last worked by Rogers Iron Mining Co. (1903-1914) producing 274,595 tons in 1957, largest production from any one mine; the Meadow at Aurora, formerly operated by Inter-State Iron Co. (1910-1915) and Cleveland-Cliffs Iron Co. (1916-1922) 94,722 tons in 1957; the Victoria, Virginia, making its last shipment in 1955 and listed as exhausted, 26,605 tons in 1957; the Wisster, at McKinley, last shipment in 1941 and also listed as exhausted, 5,380 tons in 1957; and the South Chandler at Ely on the Vermilion range, last shipment in 1942 by Evergreen Mines Co., exhausted, 3364 tons in 1957. The Shada at Nashwauk, inactive since 1905, produced 20,892 tons in 1957. Thus Pacific Isle followed its own precedent by reviving three "exhausted" mines in 1957. It was the only smaller company to ship from five Lake Superior ranges.

Rhude and Fryberger, from the Boeing and Troy mines on the Mesabi range and the Pennington and Carlson-Nelson on the Cuyuna, shipped 520,265 tons in 1957. The Boeing at Hibbing, for-

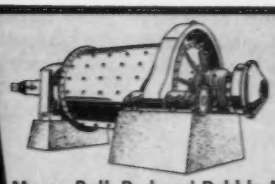
19 of the 23* Uranium Mills in the U. S.

with 85% of total U. S. Uranium concentrate capacity use

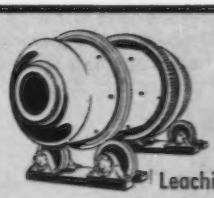
MINE & SMELTER equipment



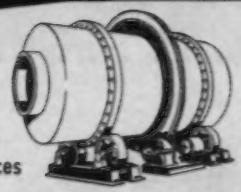
7'x 7' Acid-Proof Marcy Pebble Mill and 5'x 10' Marcy Rod Mill in Rare Metals Corporation of America's plant in Arizona.



Marcy Ball, Rod and Pebble Mills



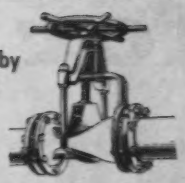
Leaching Drums



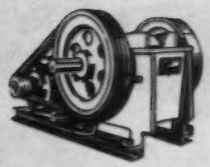
Fusion Furnaces

Burt Filters

Massco-Grigsby Pinch Valves

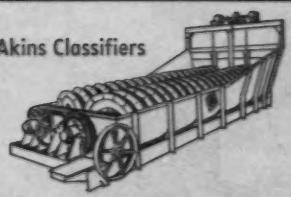


Marcy Pulp Density Scales



Massco Laboratory Equipment

Akins Classifiers



*Uranium mills in operation or under construction in the U. S. on September 1, 1957.

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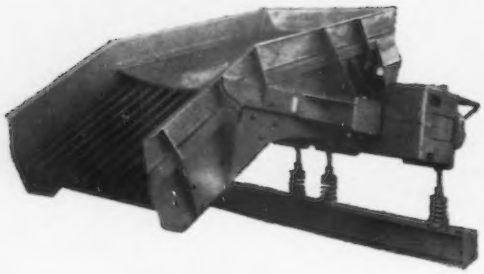

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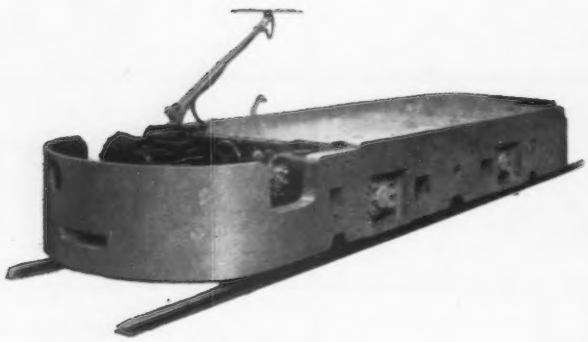
By-passes fines ahead of primary and secondary crushers, screens, picking belts. Safeguards belts by bedding them with fines, absorbing impact and preventing damage.

Vibrating Feeders

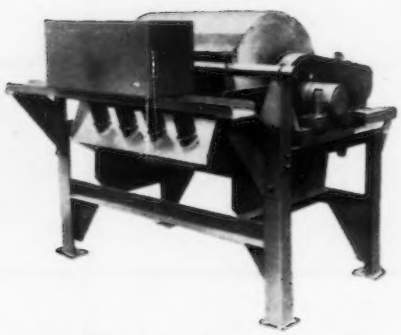
To meet all capacity requirements and for handling most classes of materials. Jeffrey feeders can be furnished with various styles of decks and in types to satisfy all operating conditions; dust-tight, spark-proof, etc.

for mining.....



Locomotives

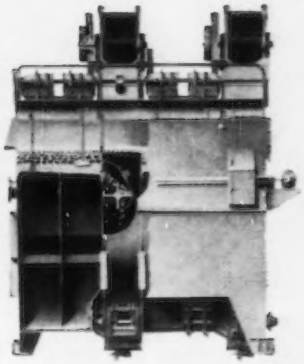
Sturdy, streamlined, easy to operate and maintain, Jeffrey locomotives are known throughout the world for their reliability and long-term service. Available in trolley, cable reel and storage battery types, in sizes to suit your requirements.



Magnetic Separators

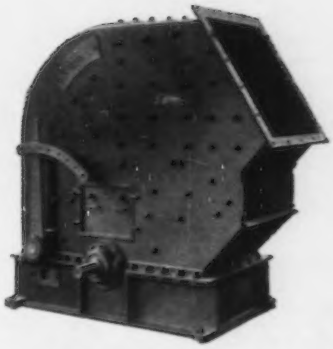
Solve wet concentration and magnetic recovery problems. Of the wet drum type, with only this one moving part, Jeffrey separators and cobbers are simple to operate. One supervisor can take care of a 70-unit plant. They're highly efficient.

and processing.....



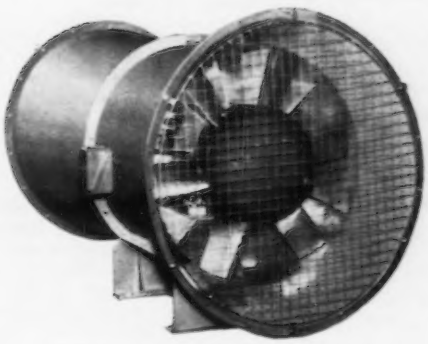
Baum Jigs

Ideal as a final concentrator or as a rougher ahead of flotation. Jeffrey air-operated jigs give exceptionally high capacity per unit of area, often ten times that of conventional plunger jigs. For years they've been handling some of the toughest separation jobs.



Rock Buster

A hard-hitting giant that's suitable for crushing large primary feed—everything that comes from the face, without preliminary sizing or picking. Also available from Jeffrey are other crushers in types and sizes to meet every sizing requirement.



Ventilating Fans

Jeffrey makes fans for every mining condition —midget blowers for auxiliaries, junior models for low pressure work, and mammoth multi-stage units for high pressure, high volume service. Jeffrey engineers assist in their selection.

Belt Conveyors

A complete range of sizes and capacities is available through Jeffrey. Permaseal belt idlers, with their diaphragm double end seals, give extra dependable service. Many companies are replacing idlers on their belt conveyors with time-proven Permaseal idlers.

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JEFFREY

Minnesota *(Continued)*

merly operated by the Cleveland-Cliffs Iron Co. (1922-1927) produced 268,263 tons. The mine has now produced a total of 4,409,912 tons, with about 2-million estimated tons remaining.

W. S. Moore Co., one of the prominent "independent" companies, shipped 457,-422 tons last season from 10 properties, all on the Mesabi range. Largest producer was the Mariska at Gilbert which, with the Mariska Extension, shipped 248,909 tons. The Mariska was formerly operated by the Republic Iron & Steel Co.(1907-191) and the Mariska Iron Co. (1920-1924). Its first shipment by the W. S. Moore Co. was in 1956 with 153,303 tons. Smallest tonnage in 1957 came from the Gilbert Silver at Gilbert, exhausted, with 2,422 tons.

Rhude & Fryberger has announced plans for a taconite plant at Gilbert which can produce 300,000 tons or more of concentrates annually.

MICHIGAN

North Range Mining Co. shipped 1,148,-873 tons in 1957 from five mines: the Book and Warner on the Menominee range; the Champion on the Marquette range; the Penokee on the Gogebic range and the Leonidas on the Mesabi. Largest producer was the Penokee at Ironwood: 514,059 tons, its best shipment since 1948. The Leonidas, near Eveleth, which is mining the shaft pillars left by the Oliver, had 202,125 tons, compared to 591,838 tons in 1956. North Range's total shipments for 1957 were about 19,000 tons less than for 1956.

Jones & Laughlin's new Tracy mine at Negaunee on the Marquette range shipped 467,386 tons in 1957. The mine will soon be developed to the point where it can produce its planned rate of 1-million tons or more annually. Its first shipment was made in 1955.

Cleveland-Cliffs Iron Co.'s ore improvement plant handles high moisture underground ores from its Negaunee mines which are dried, crushed and treated by heavy media separation. An underground 3600 ft conveyor belt at the Mather "A" mine on a slope drift between the 9 and 12 levels will have a grade of 22.22%.

Jones & Laughlin Steel Corp. has exercised its option to lease Iron county, Wisconsin, lands on which it has been conducting exploration drilling for nearly four years. The option, dated March 18, 1954, covers 1600 acres. The agreement provides for a 100-year lease. In addition the company has leased another 120 acres and bought 300 acres.

There were two fatal accidents at Menominee range mines during January, one caused by falling ground and one by the snap back of a hoisting cable during a change of cables.

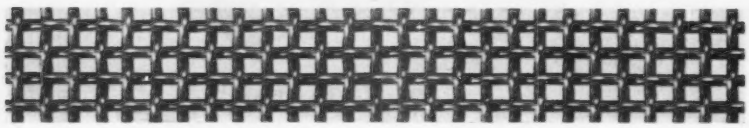
Bradley mine at Iron Mountain produced 26,074 tons in 1957 compared to 34,110 tons in 1956. Mine is operated by E. C. Bradley & Sons.

NEVADA

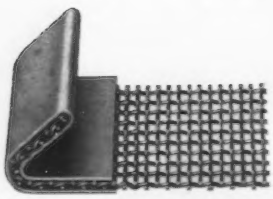
Kennecott Copper Co., Nevada Mines Division, set an all-time safety record during 1957, according to Dale J. Brown, safety director. The division carried an accident frequency rate of 4.31 per million man hours worked as compared with 17.91 in 1955 and 5.64 in 1956. During 1957 the shifts lost per million man hours worked was 2,039 as compared with 9,598 in 1955 and 3,854 in 1956. Figures were reported by the National Safety Council.

Ground survey for 23 miles of road from the Eagle Picher diatomaceous earth mine near the Trinity Mountains to U. S. Highway 40 near Lovelock is provided for in the Nevada State Highway Budget for 1958. The road is needed to transport the mine product to the new processing plant now under construction six miles east of Lovelock near Highway 40. The mine site lies about 30 miles west of the site for the new plant.

People holding mining claims in the area being appropriated by the U. S. Navy



TYLER SCREENS LAST LONGER



Tyler Type "AX" Hook Strip. For wire diameters from .047" to 5/16" inclusive.

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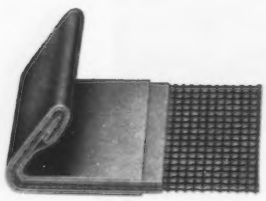
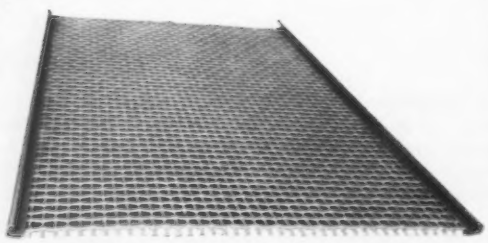
Tyler Screen Sections are furnished for all makes of vibrating screens in all meshes and metals. Each section is fabricated with the right type of edge or hook strip for the specification of screen cloth and to fit the particular make and model of screening machine on which it will be used.



Tyler Type "CX" Hook Strip. For wire diameters .041" and smaller.



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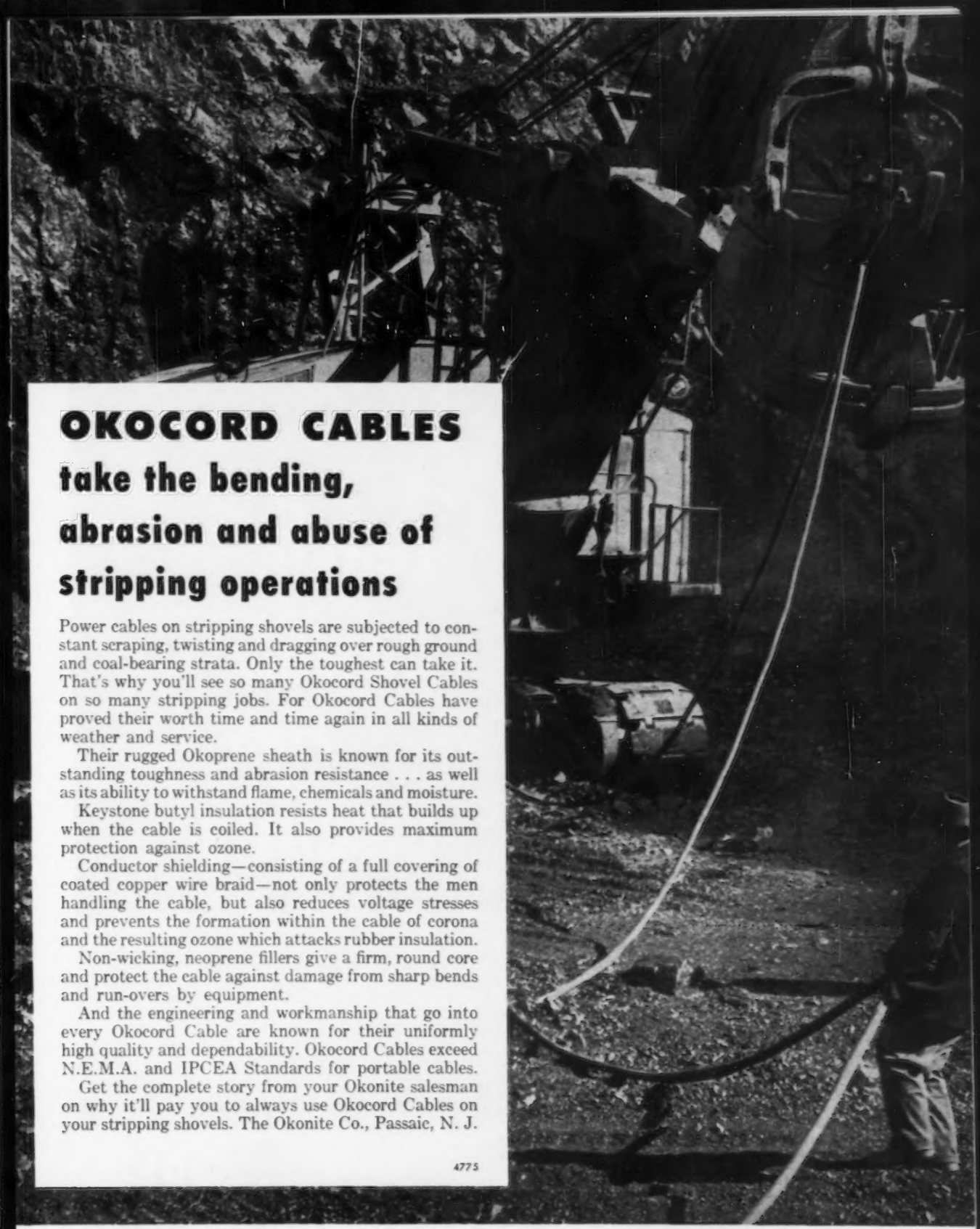

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Nevada (*Continued*)

for gunnery practice will not have to do assessment work to protect their interests, according to an announcement from Washington. The Navy's restricted area includes 654,720 acres in the Sanwave Range in the Black Rock desert area. Claim jumping will not be permitted during the time the military is in control.

Edgemont Mining Co., operating in the Centennial District of Elko county, is employing seven men five days per week and is operating two shifts. The Burrel adit has been advanced 3,200 ft, at which point the Lucky Girl vein was encountered, and workmen are now driving northeast on the vein with the expectation of encountering ore shoots indicated by work done prior to the time Edgemont took over the property. Edgemont is a gold property 40 miles northeast of Tuscarora. Thomas C. Hedlund is manager. E. F. McCurdy, who died recently in San Francisco, was the consulting engineer.

Isbell Construction Co. has completed grading the site for the new Eagle-Picher diatomaceous earth processing plant at Colado, six miles east of Lovelock near the Southern Pacific right-of-way, and pouring of concrete was started during January. Kaiser Engineers have the contract to build the big installation, and Clay Bedford Jr. is engineer in charge of the work for the Kaiser company.

Morrison-Knudsen Co. is excavating overburden at the Round Mountain Gold Dredging Corp. property in Nye county at the rate of 75,000 yd per week, and the remodeled mill, which has a capacity of 250,000 cubic yd per month is expected to start operations on March 1.

The work now going on at Round Mountain is being done with one seven-yard Bucyrus-Erie shovel, a large Marion shovel, two three-yard Bucyrus-Erie shovels, and several Euclid trucks. It is expected that removal of material will disclose veins of gold ore indicated by extensive drilling. Gold Dredging Corp. has taken a 15-year lease from Nevada Porphyry Gold Mines Inc., with the understanding that the lease may be extended for an additional 15 years. Contract with Morrison-Knudsen calls for the stripping of 33,155,000 yd of overburden, and 38,722,000 yd of material to be processed. It is estimated that the processed material will average from 75¢ to $1 or more per yard.

The long-dormant mining camp of Manhattan in Nye County is experiencing a housing shortage due to developments at the White Caps mine in that area. Drilling is now being done at the 800-ft level in the White Caps property, and good values in ore are being uncovered. Plans call for the operation of three shifts at the property beginning in the near future. During January a truck-trailer load of lumber for timbering was delivered to the site. Ore contains both gold and antimony values. George Rong is superintendent of the mine.

A contract continuing wage scales at their present level for the coming year was signed during January by representatives of the Nevada Massachusetts Co. and Local Union No. 13747, United Mine Workers of America. It was agreed that if the weather became extremely cold, one of the ball mills would be closed and the other one put into operation for seven days a week, to prevent danger of freezing during the three-day shut down periods. The crew will be alternated so that each man will receive the same number of working hours. The Nevada-Massachusetts property is at Tungsten in Pershing county.

NORTH CAROLINA

W. C. Lanier and Glenn Nance of Denton, have located a gold strike about four miles east of New London and have announced plans for launching a sizable mining operation in the area. Ore in the area, they say, has been assayed at an average of $19.95 a ton. They have leased an eight-acre tract and are setting up equipment capable of washing around 50 tpd ore on a temporary test basis and plan to install other equipment if it is determined that the mine is worth working on a permanent basis.

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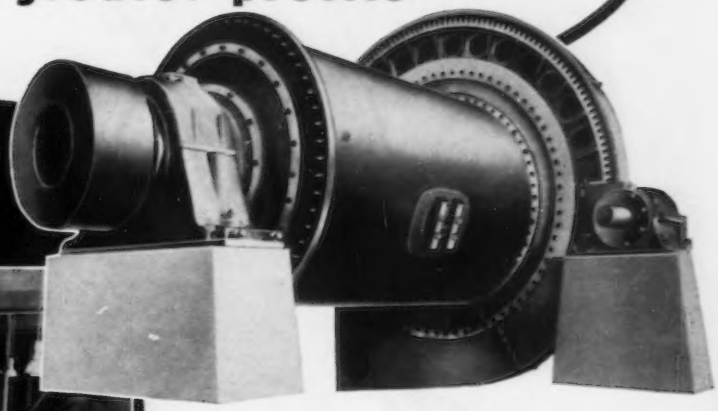

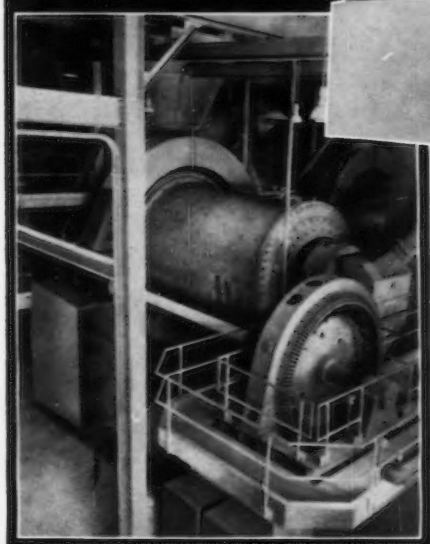

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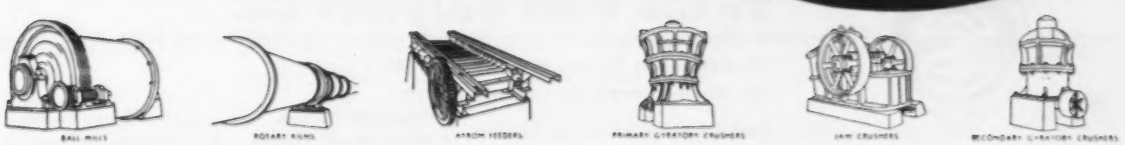

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Thirty huge coal-type hopper cars of 100-ton capacity built by Baldwin-Lima-Hamilton's Eddystone Division are now transporting washed coal from the mine to the plant at the River Queen Coal Company's properties in Greenville, Ky.

Weighing 65,000 lb., and with a level full capacity of 119 cu. yd. and a heaped capacity of 140, these are the largest coal cars ever equipped with the automatic clamshell door mechanism, a patented device which provides instantaneous dumping. Since three of them haul more coal than four 70-ton cars, these 100-ton giants reduce switching costs more than 25% on main line tracks, where charges are based solely on a per car rate.

Thirty-five similar cars for the Kansas City Power & Light Company, Kansas City, Mo., are now being built at Eddystone.

Made in all capacities and track gages, Baldwin hopper cars are noted for their long life and trouble-free service.

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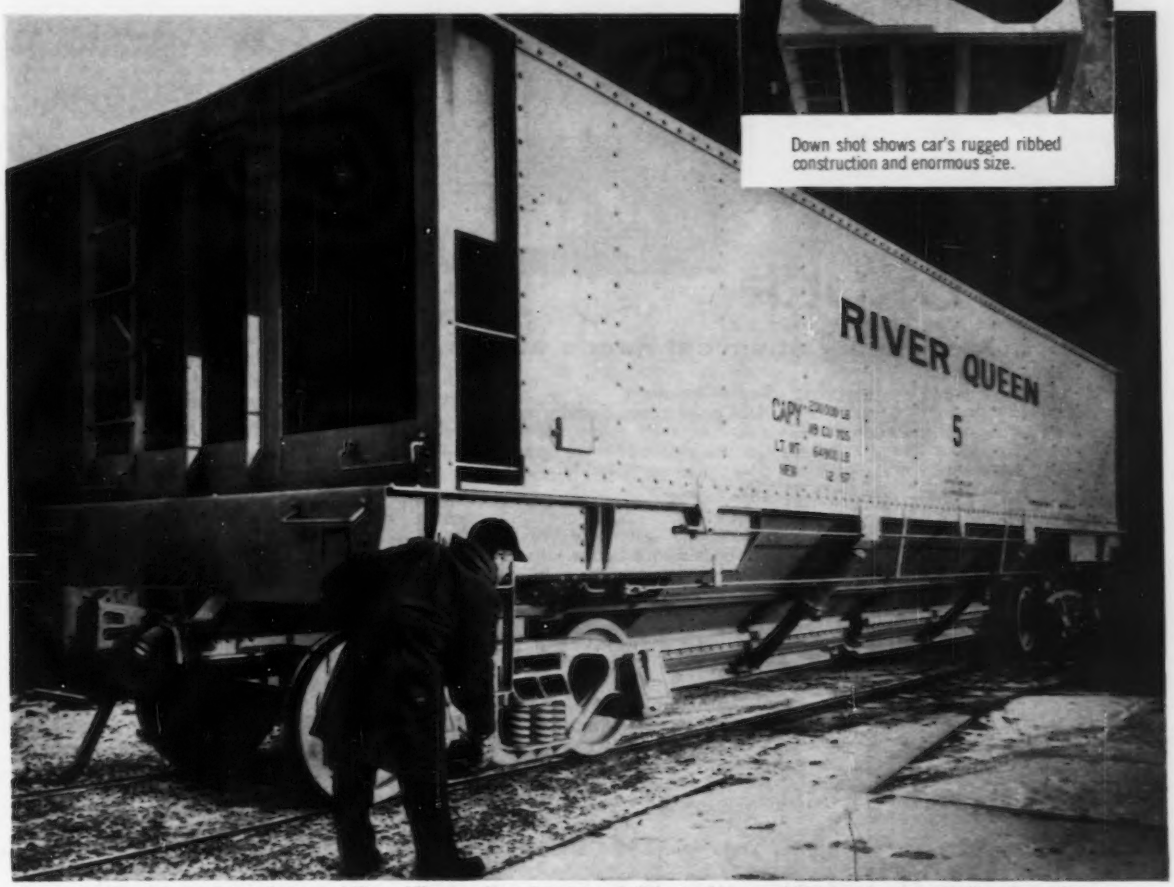
Down shot shows car's rugged ribbed construction and enormous size.



Air-operated clamshell door is tested on one of 30 new 100-ton coal-type hopper cars built by the Eddystone Division of B-L-H for the River Queen Coal Company.

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North Carolina *(Continued)*

The ore is located in an area which was known as the Cotton Patch Mine over 60 years ago and which was worked extensively by hand over the years.

An FPC examiner on Feb. 11 recommended that the Carolina Aluminum Co. of Badin, be granted 50-year licenses on planned and existing hydroelectric projects on the Yadkin-Pee Dee River in North Carolina.

Examiner Glen R. Law, reversing a ruling of the commission in April 1957 which would have limited the license period to 40 years on the company's existing dams, recommended that the FPC grant 50-year licenses for the company's existing High Rock Narrows and D Falls dams, as well as for its proposed new $15-million Tuckertown project.

Carolina Aluminum had contended that it might have to close its Badin smelting works if it was not granted a 50-year license on all hydroelectric projects, and in his decision Law pointed out that the economic feasibility of the proposed reconstruction of the Badin plant depends on such a license to assure "an adequate power supply for a long enough period to justify the huge investment."

If the recommendation is approved, Carolina Aluminum plans to spend around $22-million on modernizing the Badin plant and $15-million for a new dam at Tuckertown, which would increase the power being furnished to the Badin works by the three existing plants to 40,000 kw. The 1,255-ft dam would create a reservoir about nine miles long.

A group which calls itself "Joint Venture" has been formed to protect the interest of private landowners in future mining of phosphate in Beaufort and Hyde Counties, and in conferences with the N. C. Department of Conservation and Development officials have indicated that they are of the opinion that there is sufficient phosphate in the area to justify two mining operations.

The State only recently reopened negotiations for phosphate rights on state-owned lands in the area after the C&D Board had approved a lease agreement with Bear Creek Mining Co., a subsidiary of Kennecott Copper Co.

The matter was reopened after the Bryan Rock and Sand Company of Raleigh, which is affiliated with the General Crude Oil Co. of Houston, Tex., also interested in drilling rights in the area, declared that the Bear Creek lease was equivalent to a monopoly.

Both Bear Creek and General Crude Oil have options on a limited amount of privately-owned land in the area, and the 60,000 acres of state-owned lands on which they have their eyes is submerged land. Under the proposed lease with Bear Creek, the state would have received a minimum of $100,000 a year in royalties and Bear Creek promised to construct a $25-million phosphate processing plant in the area if such a project proved warranted.

What the state does about leasing its 60,000 acres could affect the bargaining powers of the private landowners, who say the "Joint Venture" was formed to "attempt to get an equitable contract" for any privately-owned land leased for phosphate mining.

Members of the advisory board of the Minerals Research Laboratory at Asheville were told at a meeting at Raleigh, Jan. 17 that "research being conducted at the laboratory shows great promise in the expansion of the uses of the state's minerals resources."

Chief Engineer W. T. McDaniel said that "our aim is to help the state's present mineral industries and to encourage the establishment of new industries in the field."

He reviewed various projects now under way, and discussed the flotation principle used in separating minerals in sand and olivine, and also the properties of mica.

The meeting at Raleigh was held to review laboratory activities and to acquaint visiting committee members with the programs of the N. C. State College School of Engineering.

H. A. Lamonds, supervisor of the nuclear reactor project at the college, told the group that "one of these days, you'll find radioactive techniques being used for research in your own field."

The first geological map of North Caro-

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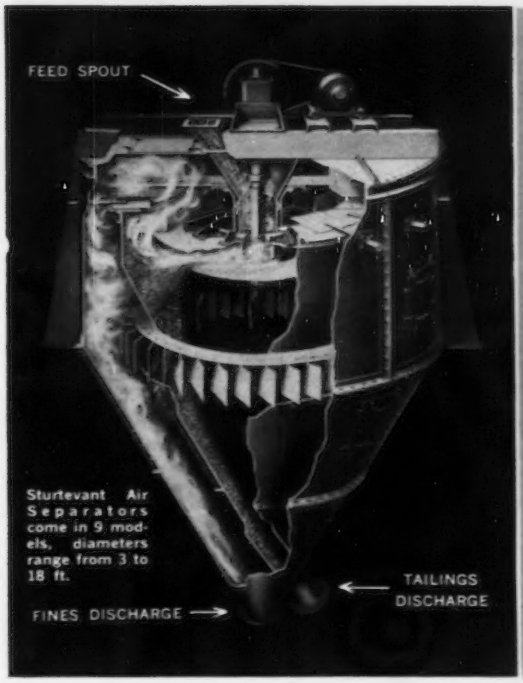
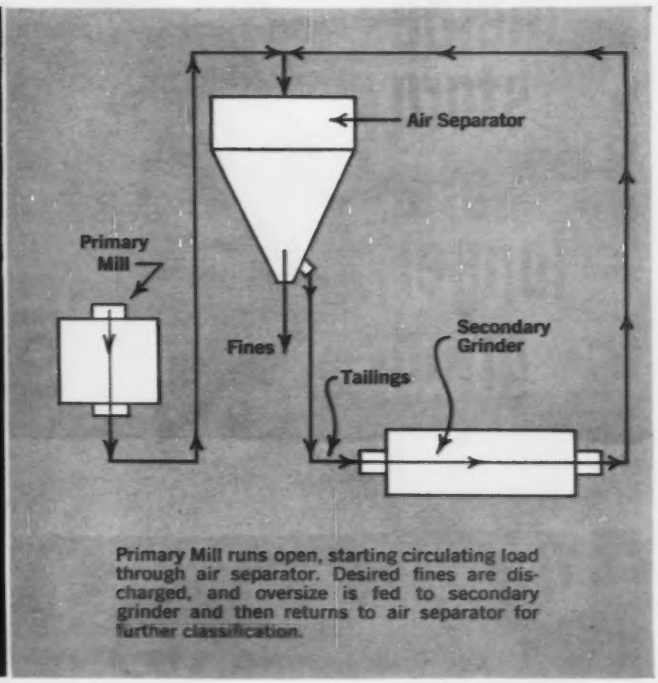
Stop Overworking Grinding Mills


FEED SPOUT
Sturtevant Air Separators come in 9 models, diameters range from 3 to 18 ft.
TAILINGS DISCHARGE
FINES DISCHARGE



Primary Mill runs open, starting circulating load through air separator. Desired fines are discharged, and oversize is fed to secondary grinder and then returns to air separator for further classification.

LET STURTEVANT AIR SEPARATION HELP YOUR SYSTEM PRODUCE UP TO 300% MORE 40 TO 400 MESH FINES — CUT POWER COSTS AS MUCH AS 50%

Fines that pass through grinding mills unhindered, serving only to increase the work load, can be quickly classified by a Sturtevant Air Separator operating in closed circuit. With all oversize automatically returned for further grinding, the result is production capacity impossible to achieve in single-pass grinding — as well as a better, more uniform product.

Closed circuit grinding and air separation is of proved advantage in *all* secondary reduction processes. Grinding mills are free to perform at top efficiency, their output frequently increased as much as 300% and power costs cut up to 50% (documented by 30 years of Sturtevant air separation experience in the cement industry). Further, attritional heat is dissipated by greater surface exposure.

Sturtevant Air Separators Keep Grinding Units At Peak Efficiency — Classify Feed Loads to 800 Tons Per Hour

Sturtevant Air Separators circulate production loads with exact control of air currents and centrifugal force. Simple adjustments make possible counter-action between the two to the point where a product of almost any desired fineness may be collected while coarser sizes are rejected.

A 16 ft. Sturtevant, for example, took a feed rate of 800 tph, containing only a small percentage of desired fines, and delivered 30 tph 90% 200 mesh, recirculating the oversize through the grinding circuit. (In the cement industry, Sturtevant units deliver up to 60 tph raw cement fines, 40 tph finished cement fines.)

Sturtevant's ability to engineer precise, high capacity classification for closed circuit grinding systems is the result of long experience with a wide variety of dry processes. Sturtevant designed its first air separator some 40 years ago — and has been pioneering developments in centrifugal classification ever since.

Current users of Sturtevant Air Separators include manufacturers of sulfur, soybeans, phosphate, chocolate, feldspar, sand, pigments, limestone fillers, abrasives, plasters, ceramics and cement.

Designed for precise separation of all granular materials, Sturtevant Air Separators have been adapted to other materials as well. Johns Manville, for example, uses a 10 ft. model to separate 3 to 6% undesirable rock from asbestos.

Ruggedly constructed, Sturtevant units are designed for minimum maintenance — at a Midwestern rock-crushing plant, a 10 ft. Separator operates outdoors year-round with only routine care.

For further information, request Sturtevant Bulletin No. 087. Write Sturtevant Mill Co., 101 Clayton St., Boston 22, Mass.

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CRUSHERS • GRINDERS • MICRON-GRINDERS
SEPARATORS • BLENDERS • GRANULATORS
CONVEYORS • ELEVATORS

inside story of a longer grind

Moly-Cop is hard and tough to the core...

A look inside this Moly-Cop ball shows a uniform, fine grain structure extending to the core. It is the result of special alloying, forging and heat treating that provides a hardness and toughness best suited to grinding needs. This is why you can expect a long, economical grind from Moly-Cop balls. It's the big reason why *Moly-Cop* balls have become the *STANDARD OF COMPARISON AROUND THE WORLD.*

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ARMCO®

MOLY-COP

TRADE MARK

COPPER-MOLYBDENUM-ALLOY

Grinding Balls

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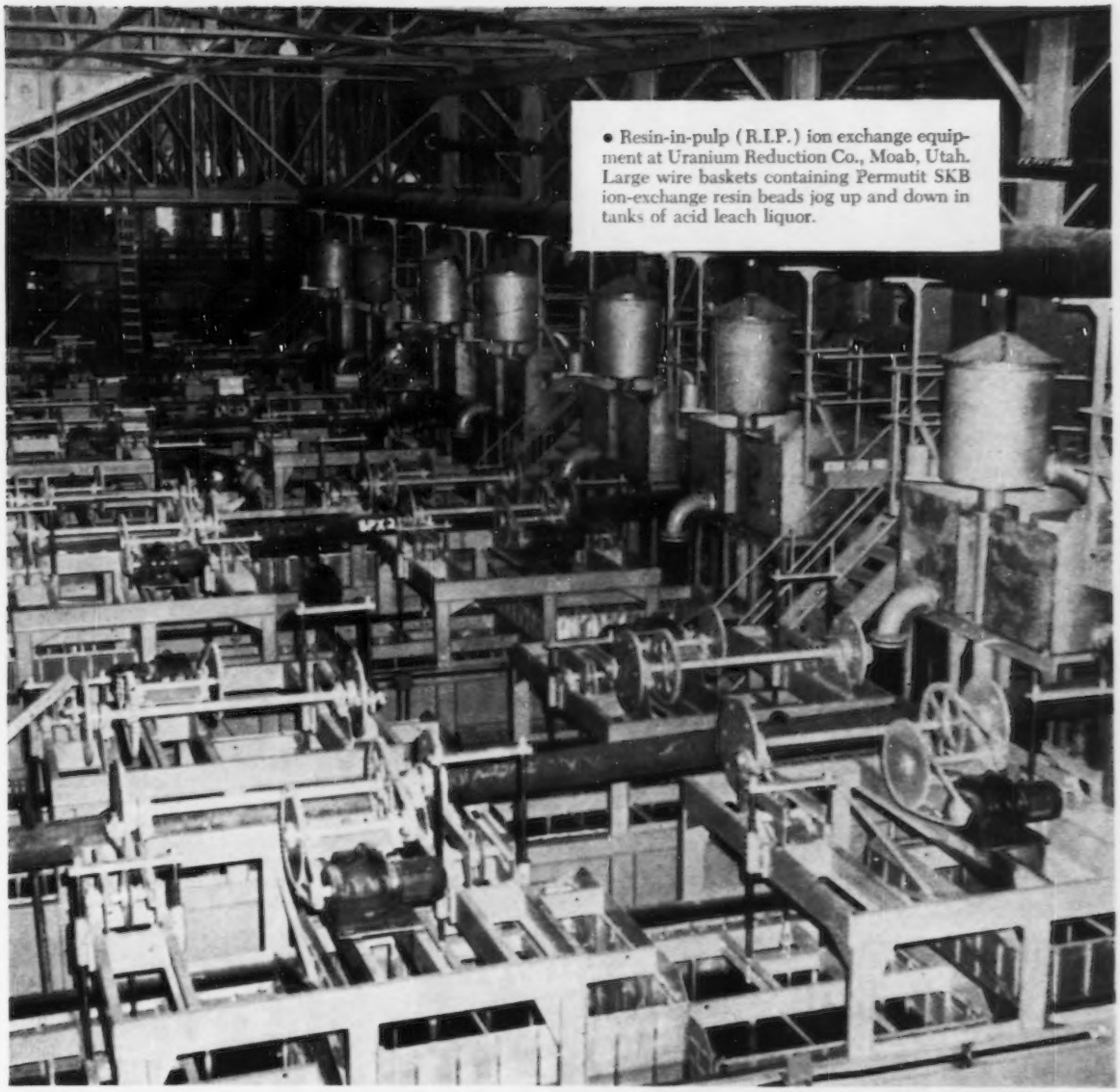

• Resin-in-pulp (R.I.P.) ion exchange equipment at Uranium Reduction Co., Moab, Utah. Large wire baskets containing Permutit SKB ion-exchange resin beads jog up and down in tanks of acid leach liquor.

Uranium Reduction Co. boosts output with Permutit SKB resin

• Uranium Reduction's mill is built around the R.I.P. process, and their engineers constantly look for better ion exchange resins.

After Uranium Reduction started using Permutit SKB resin, they reported higher plant output . . . with no noticeable loss in uranium recovery.

Permutit SKB is used in a number of R.I.P. mills for these same reasons. It was developed especially for R.I.P. uranium extraction. It disperses well, preventing "blinding" of the baskets and improving resin-pulp contact. Its unique chemical structure gives it fast loading for high uranium recovery, high capacity and fast elution. This results in extremely high concentrations of recovered uranium particularly in nitrate elution systems. It also means low precipitation costs and a high purity uranium.

Permutit SK (finer mesh than SKB) offers the same chemical advantages when used for uranium extraction in conventional ion-exchange columns.

We'll supply full details and samples to help you evaluate Permutit SK, SKB or other Permutit ion exchange resins for your requirements. Write: The Permutit Company, Dept. EMJ-3, 50 West 44th St., New York 36, New York or The Permutit Company of Canada, Ltd., Toronto 1, Ontario.

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Send us your haulage problem today!

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North Carolina *(Continued)*

lina since 1875 is expected to be available by May, according to Dr. J. L. Stuckey, head of the State Department of Conservation and Development's minerals resources division.

Purpose of the multi-colored map, he said, is to furnish information as to the basic rock formations in the state and to provide mining companies with something with which to make detailed area maps in prospecting for minerals in the state.

The growing interest in mining in North Carolina increased the long-felt need for a new map. The 1875 map became outdated and for the past 25 years all North Carolina has had to offer was an enlargement from a U. S. Geological Survey map which shows only the major resources and no subdivisions.

Field work for the new map was started during the summer of 1955 under the direction of Dr. Stuckey, who took over as full time director of the minerals resources division that year after having worked with it for 15 years on a part-time basis while also serving as a geology professor at N. C. State College.

OREGON

Expansion of operations of Oregon Metallurgical Corp., Albany, producer of ingots and castings of zirconium, titanium and other rare metals, will follow a $1-million increase in the firm's capitalization.

Stockholders of Oregon Met, meeting in Albany, (1/30) authorized a 500,000 share increase to 2,500,000 and sale of 500,000 shares at $2, twice par value, to Northwest-Pacific Co., a newly formed corporation. Stock of Northwest-Pacific is owned by an undisclosed firm active in the rare metals field, which will become a major Oregon Met customer. NW-P also optioned 750,000 additional shares at $2.

Stephen M. Shelton, general manager of Oregon Metallurgical, said the additional capital is needed to expand operations and diversify equipment so that the company may be ready to supply new metals as they come into demand.

Now working on a $4-million contract to supply zirconium ingot to Westinghouse Electric from zirconium sponge furnished by the Albany plant of Wah Chang Corp., Oregon Met has among pending contracts one to supply $450,000 worth of castings for Boeing Airplane Co. over a two-year period.

UTAH

Floyd B. Odlum's Atlas Corp. has acquired a 22.7% interest in Radium King Mine in San Juan County as an outgrowth of its sale of Petro-Atlas assets to American Petrofina Co., Dallas, Tex.

American Petrofina was a partner in the mine with English Oil Co., Salt Lake independent, and banking interests

B.F.Goodrich

Tires haul 25 tons of coal or rock, give strip miner 2 retreads!

SHENANDOAH STRIPPING operation of Reading Anthracite Co. Firm reports more mileage, more retreads with B.F.Goodrich tires.

SIXTY-THREE giant trucks haul 20- to 25-ton loads of coal for the Reading Anthracite Company of Shenandoah, Pa. Weather ranges from 10° below zero to 100° above. Roads are rocky, winding and mountainous.

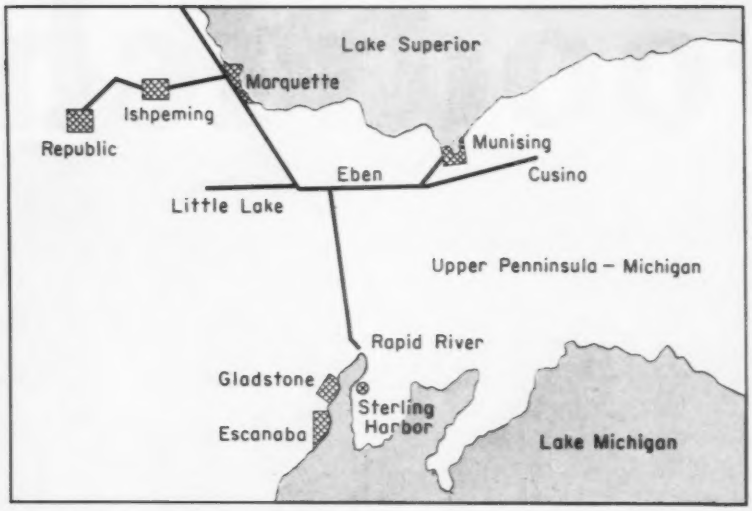
Because of this tire-killing work, the Reading people were plagued by blowouts from rock impacts. Mileage was disappointing, and often tires could not be retreaded. Then the company began using B.F.Goodrich FLEX-RITE NYLON Rock Service tires. Result: substantially more service than from other tires—as many as 2 retreads per tire with up to 80% of original service on each retread.

This experience is typical. Miners report more retreadable tires and longer, trouble-free service from B.F.Goodrich Rock Service tires. Husky cleats grip the ground for positive traction in forward or reverse. And the B.F.Goodrich FLEX-RITE NYLON cord body is stronger than ordinary cord materials, withstands double the impact and resists heat blowouts and flex breaks. That's why it outwears even the extra-thick tread, can be retreaded again and again.

Your nearby B.F.Goodrich dealer will show you his complete line of money-saving tires for mine work. See him today or write *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

Your B.F.Goodrich dealer is listed under Tires in the Yellow Pages of your phone book



NEW HARBOR opposite Gladstone will handle pellets from Cleveland-Cliffs and Ford Motor Co.'s operations on the Marquette. Loading will be by conveyors.

LS&IR Plans New Loading Dock for Pellets

WITH APPROVAL of trackage grade between Rapid River, Mich., and a point opposite Gladstone, Mich., the Lake Superior and Ishpeming Railway Co. is progressing toward a planned loading dock for pellets from Cleveland-Cliffs' Eagle Mills operation.

Dock, of steel and concrete construction, will be about 900 ft long and 60 to 70 ft wide. Loading of ore ships traversing Lake Michigan to Chicago will be by conveyor belts, with provision to shorten the loading drop into the ship's hold, a hazard in loading pellets. Cost of the new dock will near $7-million. LS&IR will also increase its rolling stock.

Approval came after arrangement with the Soo Line in which the two railroad firms exchanged interests in each other's ownership of trackage between Eben Junction and Rapid River and Eben Junction and Marquette. Soo is controlled by Canadian Pacific, LS&IR by Cliffs.

Marquette Range mines, include the Humboldt, owned by Cleveland-Cliffs and Ford Motor Co., are tapping a source of some 365-million tons of concentrates. Pelletizing is taking place at Eagle Mills, a point between Negaunee and Marquette. The Escanaba docks, also on the bay, have reduced capacity over the years and, according to LS&IR, are unable to handle pelletized ore. Escanaba will handle an estimated 6-million tons of ore this year.

Utah *(Continued)*

in Utah and southwestern Colorado.

J. A. Minton, president of English at Salt Lake City, said the mine produced 189,344 tons of uranium ore during December. Shipments go to the Mexican Hat mill of Texas-Zinc Minerals Corp. "We believe we have the largest mine in the White Canyon uranium district," Mr. Minton said.

An experimental rod mill is currently being installed at the Arthur ore concentrating mill of the Utah Copper Division of Kennecott Copper Corporation, according to F. C. Green, assistant general manager.

Mill, which utilizes steel rods instead of iron balls to grind ore, is expected to undergo initial tests early this year. It will be housed in a separate building.

Installation and testing of the $255,000 rod mill is part of the company's continuing effort for better and more economical production methods in view of today's highly competitive copper market. The search for better equipment is part of this effort.

Delhi Taylor Oil Corp. has discovered a vast new, high grade potash deposit at "shallow" depths at Cane Creek in Grand County.

As a result, the firm is reported now competitive with production which in next two years will be flowing in from deep shafts in western Canada.

Delhi-Taylor had been marking time on a $20-million potash development at Seven Mile Anticline about 9 miles northwest of Moab. Cane Creek is due west of Moab in the gorge of the Colorado River.

WASHINGTON

Daybreak Uranium, Inc., Spokane, is planning to begin underground work at its open pit mine on Mount Spokane. An underground excavation is planned to be 10 ft high and about 30 ft wide, extending at an angle of 15 deg along the present mineralized zone of the Dahl lease.

The firm plans to mine between 30 and 50 tons of ore averaging 0.40% uranium oxide, which will be blended with a lower grade stockpile of ore that averages about 0.12 to 0.15%. The work is expected to start in early March.

Kae Sowers, secretary-treasurer of Daybreak, said that the firm to date has mined and shipped about 12,000 tons of ore.

Spokane office of the Bureau of Land Management said recently that it examined some 77,000 acres of land in Stevens county during the past summer and found that approximately 7000 acres could be classified as having mineral value. Most of the area, it was added, was covered by various mineral claims.

The bureau said that the work, which was handled by four crews of mining engineers and geologists, was part of a 10-year program to check all unpatented mining claims on public domain and national forest lands.

Pacific Northwest Alloys, Inc., announced plans to shut down its ferrochrome plant at Mead by mid-February. Lack of orders was cited as the reason.

The company reported it had excessive stockpiles of ferrochrome, which it normally sells to the steel industry. The firm has been operating in recent months with a staff of about 100 men, about 275 less than normal. In January, the company said it had been negotiating with the Government for the purchase of the Mead plant, which it has been leasing.

Newly-organized Inland Empire Mining Co. of Port Angeles has purchased manganese crushing machinery for installation on a waterfront site at Port Angeles, according to E. R. Gehrke, president. Gehrke believes availability of the equipment will permit the operation of many manganese claims on the Olympic Peninsula between the Quinault River and Hood Canal. After the first plant is in operation, other plants may be constructed on the Peninsula nearer the ore supply, Gehrke said.

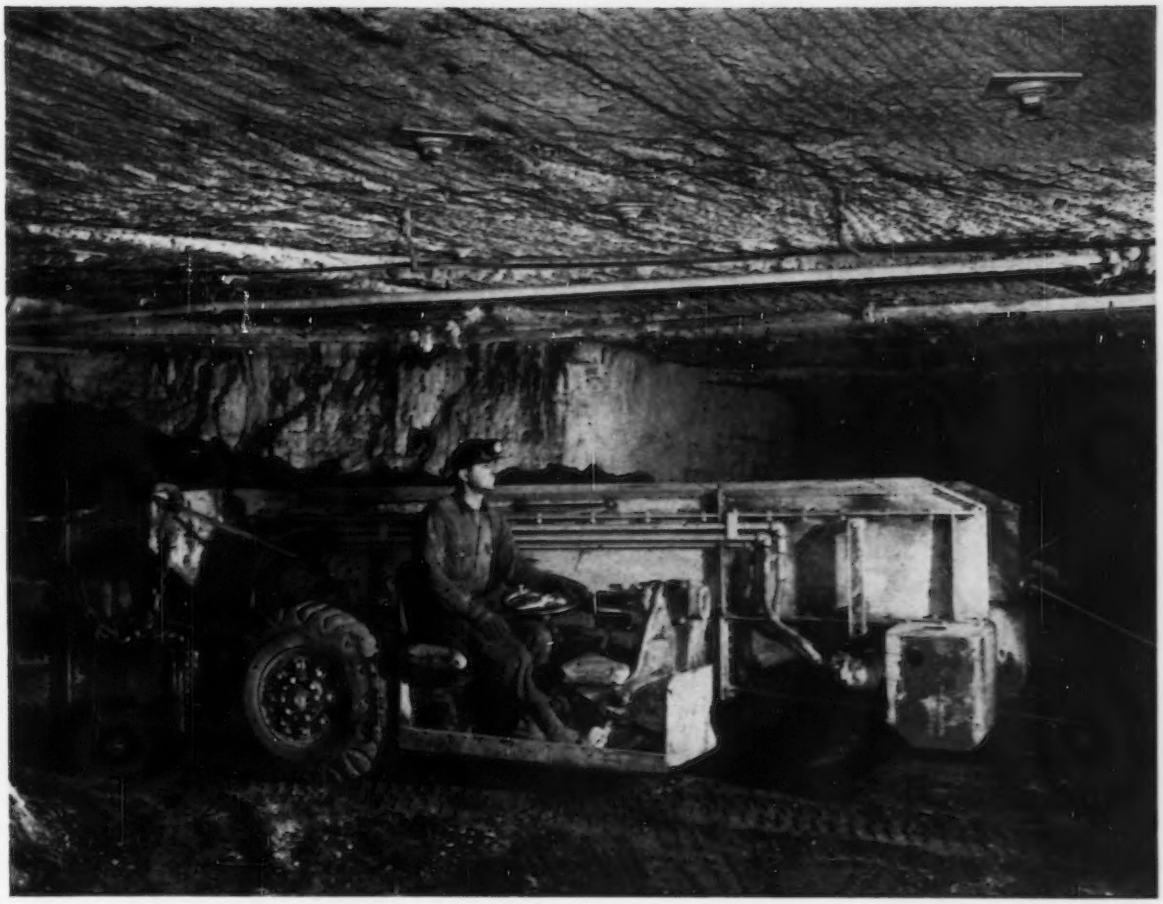
A net loss of $27,287 for 1957 was reported by North Star Uranium, Inc., Spokane. The company said it shipped 540 tons of uranium ore to Vitro Uranium Co. at Salt Lake City and to Dawn Mining Co. at Ford, Wash., during the year.

The ore as mined at the Lehmbecker lease in the Mount Spokane district.

Meanwhile, John F. Campbell, president of the firm, said North Star has leased property near Colville, Wash., where he said there were good showings of barite. The company also has applied for a 160 acre lease on the Spokane Indian reservation, where the company plans to explore and develop a potential uranium property.

WYOMING

Atomic Energy Commission will grant no new concentrates purchase contracts in Wyoming's Gas Hills district until it completes a study of this and other domestic uranium areas, it was announced.



How to bolt your roof...quickly

You can anchor your roof in jig time when you use Bethlehem square-head roof bolts equipped with expansion shells. Simply use your regular drilling equipment and an impact wrench.

Besides saving time, roof bolting does so much to promote safety by locking the overlying rock layers in place. With heavy timbers no longer taking up so much room, it's easier to move mechanized equipment. Ventilation is improved and fire hazards are reduced. And there's less need for large storage areas, both above and below ground.

The Bethlehem square-head roof bolt is used with a leaf-type malleable-iron shell, which is fastened to the leading end of the bolt. As the bolt is tightened in the hole, the leaves of the shell expand, locking the assembly in place. A square roof plate furnishes additional support. A hardened washer reduces friction which may occur between the bolt head and roof plate.

THREE TYPES OF SQUARE-HEAD BOLTS

Type	Diam. In.	Typical Breaking Load, lb
Carbon	¾	24,000
High-Strength	⅝	24,000
High-Strength	⅞	45,000

If you're thinking about doing some roof bolting, let one of our engineers give you full details. Just phone or write our nearest sales office.

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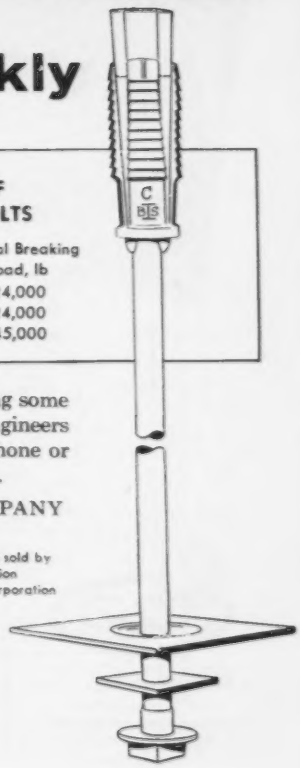

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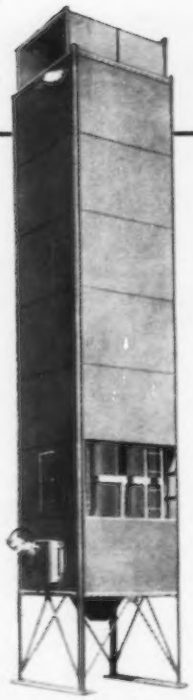
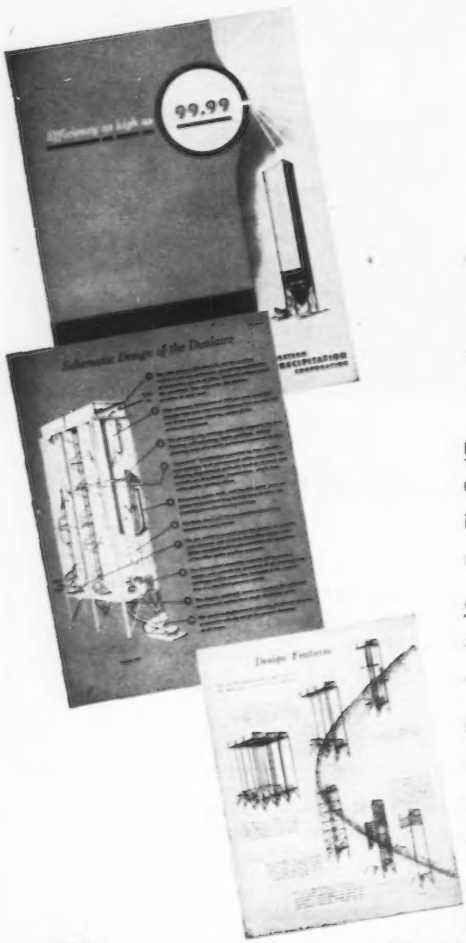


- *Cleans without jarring or rapping!*
- *Maintains uniformly low pressure drop!*
- *Field-proven efficiency as high as 99.99%!*



Backed by the same organization that pioneered commercial application of COTTRELL Precipitators and MULTICLONE Collectors, the DUALAIRE Reverse-Jet Dust Collector is revolutionizing filter-type recovery systems. The DUALAIRE gives you vital advantages like these . . .

REVERSE-JET CLEANING ACTION cleans the filter tube continuously in small increments—not with sudden surges as in rapping or jarring.

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FILTER UNITS LAST LONGER because they are not subjected to intermittent jarring, rapping or vibration—all destructive to filter fabrics.

The above are only a few of the many important advantages you get in DUALAIRE Dust Collectors. A new 8 page booklet gives the full story . . . explains how reverse-jet cleaning action works—provides facts, figures and illustrations that will change your thinking on filter-type recovery systems. Send for your free copy of this descriptive booklet—or see your nearest Western Precipitation representative!

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To achieve these unique properties, Varian uses the proton free-precession principle which relies on an immutable nuclear constant (of the hydrogen atom). Other Varian magnetometers operating on this same principle are in use in magnetic observatories, airborne surveys, underwater surveys and in space vehicles.

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How a little give adds a lot of life to... AMSCO CRUSHER PARTS

Concave ring and mantle of this *Hydrocone* crusher are made of the toughest steel known... Amsco Manganese Steel. It *gives* a little, to take more punishment. *Hydrocone* is a registered trade-mark of the Allis-Chalmers Manufacturing Company.

Both mantle and concave ring crush a lot more feed because of certain properties of Amsco® Manganese Steel. The metal *gives* a little under crushing forces, absorbs stresses, resists cracking and chipping. Yet these same forces work-harden the surface of Amsco Manganese Steel to as much as 500 Brinell... a high hardness, stubborn to wear.

Amsco Manganese Steel Crusher Parts maintain their ductile undersurface and work-hardened surface even when worn thin. That's why Amsco parts endure severe abuse for so many work hours without letup.

To be sure of getting Amsco Manganese Steel, order replacement parts from your crusher manufacturer. Amsco makes manganese steel parts for most manufacturers of crushing, grinding and pulverizing equipment.

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Wyoming *(Continued)*

Uranium exploration in Fremont county fanned out into a new area when W. W. Spees of Riverton filed 114 lode mining claims in the Sweetwater river area east of Atlantic City.

Columbia-Geneva division of U.S. Steel Corp. has arranged a swap of land with the U.S. forest service to acquire 2,316 acres of forest land near Atlantic City, where the company is studying the feasibility of developing low grade iron ore deposits.

Under terms of the agreement Columbia-Geneva bought 2,433 acres of privately owned land in the Medicine Bow National forest in southeastern Wyoming and traded it for land near Atlantic City.

First uranium ore has been run into the milling section of Lucky Mc's 750-tpd mill in the Gas Hills.

The first crushing units, conveyors and other equipment up to the acid section were being checked out in mid-February.

The ore will not be run into acid sections of the mill until later. The mill is scheduled to go on stream in March.

Articles of incorporation of Washakie Exploration Inc. have been amended to permit a more expanded operation in uranium, including a change in the firm's name to Western Standard Uranium Inc.

The firm controls eight uranium leases on the Wind River Indian reservation in Fremont county.

E. L. and Marion Lockhart have formed a new company, Marlock Mining Corp., to mine and develop a small uranium ore body near Douglas.

Lockhart has been field superintendent for Globe Mining Co. He said the orebody near Douglas is about equi-distant between Riverton and Edgemont, S. D., ore buying stations.

United Western Minerals has acquired an option to lease 980 uranium lode claims held by Vipont Mining Co.

They include the Stonewall, Trail, Black Rock and Blue claim groups in the East Gas Hills area of Fremont and Natrona county, Wyo.

United Western minerals has until July 26, 1959, to exercise the option on 651 claims and until April 1, 1958, to exercise the option on the other 329.

IN CANADA

QUEBEC

Dominion Steel and Coal Corp. has grouped its 23 individual companies into four main operating divisions: mining, steel production, steel fabrication and manufacturing, and transportation. This is the first major reorganizational step taken by the parent A.V. Roe Canada Ltd. since the latter acquired 76% of Dosco stock.

Promising new ore zone has been found at Barnat Mines Malartic area gold

CHEMICALS FOR ORE DRESSING

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Potassium ethyl xanthate
Sodium isopropyl xanthate
Potassium isopropyl xanthate
Sodium sec. butyl xanthate
Potassium butyl xanthate
Potassium amyl xanthate
Potassium hexyl xanthate
Diethyl and Dihexyl xanthogens
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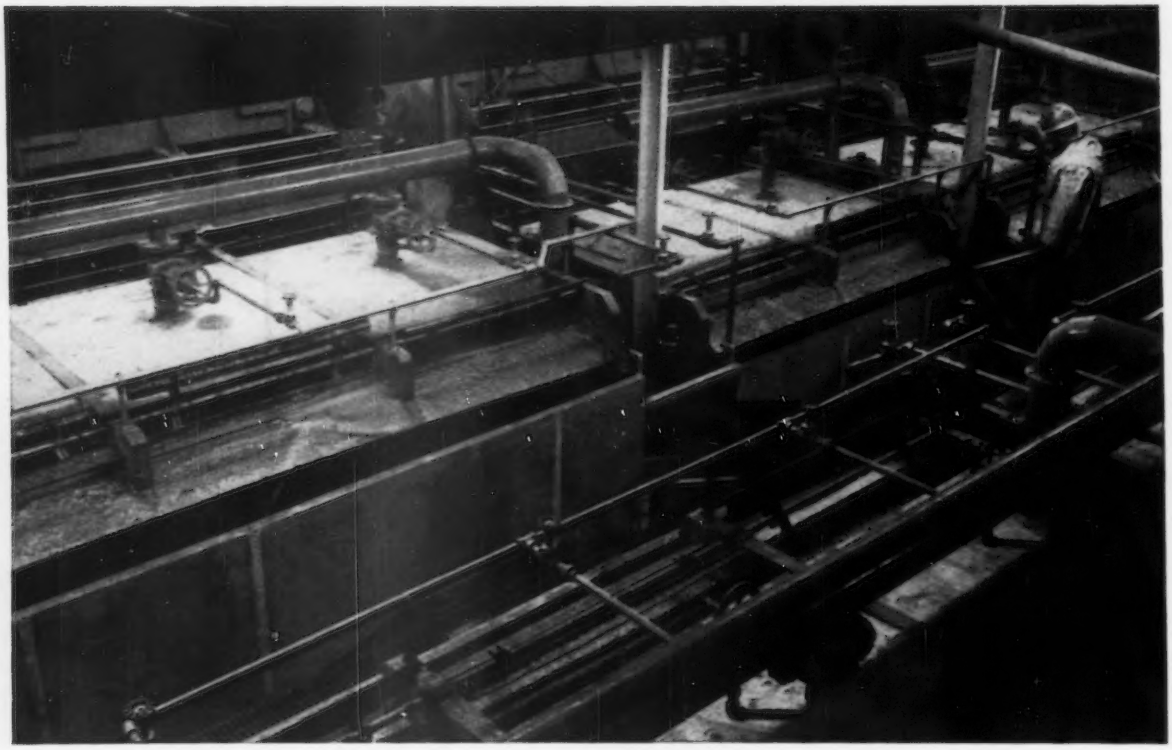


MODERN PIONEERS—The Cleveland-Cliffs Iron Company in Michigan is one of the pace setters in the conversion of low grade, nonmagnetic iron ore into a high iron content product. Pamak fatty acid is being used in the flotation phase of beneficiating the specular hematite material on the Marquette Range of Michigan.

PAMAK® FATTY ACID BOOSTS ORE RECOVERY

New techniques for processing low grade ore are the big news in the mining industry. Key to the process is beneficiation, and Pamak fatty acid has already demonstrated its usefulness as a collector in the beneficiation of such ores as Spodumene, Barite, Ilmenite, Fluorspar, Manganese oxide ores, and Scheelite.

Efficient recovery methods require a fatty acid of consistent high purity. Pamak is manufactured at Hercules' modern fractional distillation plants at Franklin, Virginia and Savannah, Georgia and also available in Canada. It is produced under continual quality control supervision to provide you with a fatty acid that is consistently more than 90% pure.

We'll be glad to discuss your specific requirements. For specifications and additional information, write:

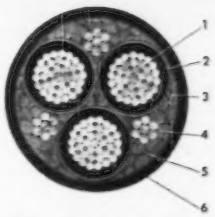
Industrial Chemical Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

PT56-1



1. Power Conductor. ASTM Class B stranded, annealed bare copper (aluminum conductors also available), shielded with a semi-conducting tape.

2. Insulation. Rolene (polyethylene), complies with IPCEA and ASTM standards—suitable for maximum continuous conductor temperature of 75 C.

3. Electrostatic Shielding. Bare copper shielding tape over semi-conducting bedding tape on each insulated conductor.

4. Grounding Conductors. ASTM Class B stranded bare copper—one grounding conductor in each interstice *in direct contact* with electrostatic shielding.

5. Assembly. Three shielded power conductors cabled with fillers and grounding conductors.

6. Jacket. Rome Roseal, special black flame-resistant polyethylene, over the cabled and taped assembly —excellent mechanical and electrical properties.

How to plan a money-saving mine substation installation

You'll save money on mine substation installations if you use Rome's MPT in place of conventional rubber and neoprene cable wherever you have a power supply system that's designed for relatively steady loads and protected against excessive overloadings.

Here are four ways you can lower your mine substation costs:

1. You pay less to start. For instance, in the case of size 2 AWG 3-conductor 5 KV cable, Rome's MPT costs about 28% less than rubber-insulated and neoprene-sheathed cable.

2. Reduce handling costs. Rome's MPT is lighter in weight—so it's easier to work with. You can use smaller fittings because diameters are smaller. When you have to relocate a cable, you can do it much more easily with lightweight MPT.

3. Get longer suspensions. You reduce strain on supporting members when cable is end-suspended in boreholes or aerially-suspended—because over-all weight is down as much as one-third. When conductors are supporting members in end-suspended borehole applications, lightweight Rome MPT gives you 33% longer suspensions than conventional cable.

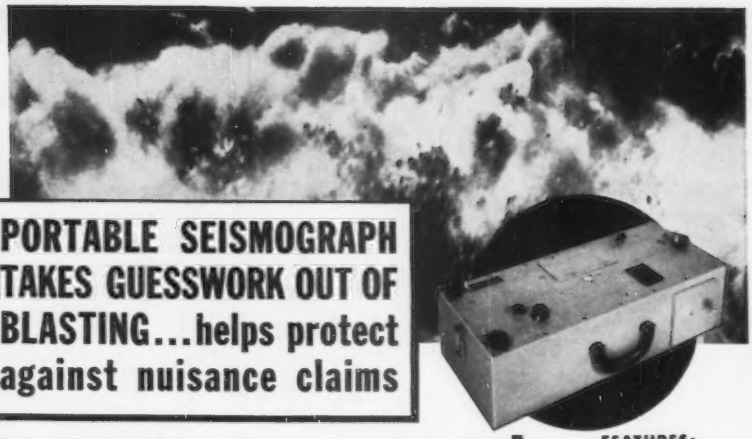
4. Cut replacement costs. Get exceptionally high resistance to acids, oils, moisture, abrasion, heat and mechanical damage—thanks to Rome's MPT Rolene (polyethylene) insulation together with Roseal (flame-retardant polyethylene) jacket.

In addition to low-cost borehole installations, you can economically use Rome MPT in shafts, or horizontal runs in underground entries. It may be buried in a trench or suspended on insulators.

Rome's MPT Power Feeder Cable comes in sizes 6 AWG to 250 MCM, 3-conductor, rated to 5000 volts and higher. Contact your nearest Rome Cable distributor for full particulars—or write Department 511, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION



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If you blast regularly, a Sprengnether seismograph can furnish you with accurate, permanent records of the ground displacement.

By studying these records, you can determine the most effective charge and proper timing of delays. Helps improve both efficiency and safety of your operation.

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It takes only a few minutes to learn to set up and operate this instrument. No previous experience or technical training is necessary.

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LIGHT—LEAN

Ready to prospect anywhere

Acker's Hillbilly diamond core drill is light and lean without fancy extras or troublesome gadgets. Acker designed this rugged marvel specifically for mineral prospecting.

To save weight and expense it contains only the barest essentials, yet it's completely self-contained with power plant, planetary type drum hoist, welded tubular steel skid frame and when needed, a built-in water pump.

Two tried and proven models available:

Screw Feed weighing 872 lbs.
Hydraulic Feed weighing 1050 lbs.

For complete Hillbilly specifications and information please write for Bulletin 29-EMJ.

ACKER DRILL CO., Inc.
P.O. BOX 830 • SCRANTON, PA.

Full 360° swivel head permits drilling at any angle. The hinged drill head swings out of the way and the powerful drum hoist conveniently lifts or lowers drill rods when adding or removing drill rods.

A drum hoist, with ample fairleads and pulleys for winching the rig into position, makes the Hillbilly "the drill you can take with you!"

Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment

Quebec *(Continued)*

property. Estimates of new zone run from 800 tons per vertical ft averaging 0.30 oz gold per ton at 900 ft horizon to a possible 1,170 tons per vertical ft averaging 0.287 oz above the 900 ft horizon.

Quebec Lithium Corp. got off to a good start this year and promises to surpass records achieved in 1957. Production in 1957 amounted to 257,013 units of lithia, valued at $2,827,143, up from 239,392 units, valued at $2,560,454 in 1956.

A major iron ore mining and milling project is shaping up in the Mount Reed-Mount Wright areas under the direction of Quebec Cartier Mining Co., wholly owned subsidiary of U.S. Steel Corp. Although no official announcements have been made, it's understood that plans call for an eventual mining operation of more than 60,000 tpd, or an annual output of 8-million tons of concentrates.

ONTARIO

Bancroft area's Faraday Mines plans to deepen its No. 1 shaft to open four additional levels at 150 ft intervals. Production operations give average grade running around 2.0 lb uranium oxide per ton and mill recovery averages about 92%.

Gold production at New Dickenson Mines (Red Lake area) is being maintained at record level. 1957 output reached an all-time high of $2,946,420 from 163,793 tons milled. 1956 output was $2,540,156 from 156,980 tons treated.

Amalgamated Rare Earth Mines is negotiating for funds to construct a 1,000 tpd mill for its three uranium properties in the Bancroft area. The company holds a letter of intent from Eldorado Mining and Refining for sale of $27.5-million worth of uranium oxide concentrates for delivery prior to April 1962. A contract is dependent on completion of the financing.

Ontario Mines in 1957 turned out a record production valued at $739.2-million, an increase of $88.3-million over 1956. Uranium accounted for most of this increase: production totalled 7,609,049 lb uranium oxide, valued at $78.2-million, up from $9.3-million the previous year. Although 337.9-million lb copper were produced, compared with 312.5-million lb in 1956, value was down from $128.5-million to $97.1-million. Value of metallic minerals increased more than $74-million to $595.6-million.

BRITISH COLUMBIA

Empire Development Co. is closing down its Port McNeil, Vancouver Island iron mine from which it recently negotiated to ship $10-million worth of iron ore to Japan.

NI-HARD cuts operating costs in dredging operation. Critical parts are NI-HARD in this pump built by Meckum Engineering, Inc., Ottawa, Ill. Pump was subject to the abrasion and impact of 3,000,000 cubic yards of fill in dredging operation for the Offutt Air Force Base, Omaha, Nebraska.

Shipped to new job...

NI-HARD pump still efficient after handling 3,000,000 yards of abrasive fill

In this pump, side plates and throat ring are NI-HARD* abrasion-resistant nickel iron castings.

This pump took the abrasive battering of 3,000,000 cubic yards of fill material . . . *without failure.*

It operated over a period of nine months handling 20% solids: . . . sand, gravel and rocks. The fill was needed for an airport runway being extended 4,231 feet to handle heavier and faster jet planes. Fill was needed to a depth of 38 feet in places. At the end of that time, the NI-HARD parts were still in good shape and the pump was resold for another dredging operation.

Applications like this are made to order for NI-HARD iron, a metal with outstanding abrasion resistance.

Complete information available

Inco's 58-page booklet: "Engineering Properties and Applications of Ni-Hard" shows how you can use Ni-Hard castings profitably. Gives full particulars on performance and properties. It's yours for the asking. Just write.

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a COMPLETE LINE of bits for all soft-medium-hard formation drilling

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NEW RESULTS OF MONSANTO RESEARCH IN USE OF AMMONIUM NITRATE AS AN EXPLOSIVE

Typical shot with Monsanto's new kind of prilled NH_4NO_3

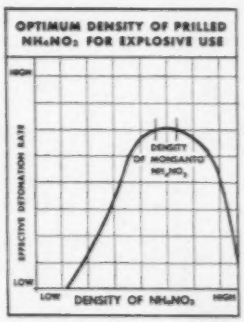
View of area involved in the blast. Shot was made in heavy columnar basalt at dam site. Used as an explosive: a new, top-quality, prilled NH_4NO_3 that Monsanto research developed to give you optimum savings, safety, speed and ease of handling.

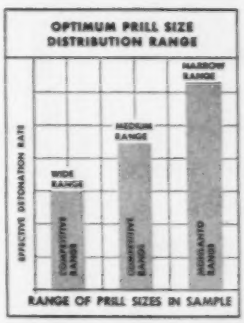
View at time of detonation. The system of detonation recommended by Monsanto, in conjunction with Monsanto Ammonium Nitrate, will yield equivalent pound-for-pound results with 60% gelatin dynamite at one-fourth the cost.

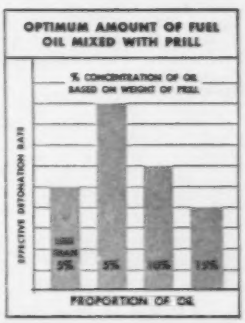
Results of blast. The powder factor in the shot above was 0.4 lbs. per cubic yard. Breakage of rock was considered ideal by contractor. Monsanto's experienced staff can give you complete technical service. Just phone Monsanto.

Photos courtesy of MORRISON-KNUDSEN COMPANY, INC.

Monsanto Ammonium Nitrate is now produced according to the specifications determined by these findings of Monsanto research. Result: more effective blast at greater savings. Monsanto is the world's largest manufacturer of prilled ammonium nitrate—and leader in developing the use of NH_4NO_3 as an explosive for open work. Request report presenting latest research findings.







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MERRICK SCALE MFG. CO. PASSAIC N. J.

British Columbia *(Continued)*

Empire president James A. Scott said that severe weather caused the shutdown. However he said the planned reopening in April would be governed by re-appraisal of production costs, "particularly that iron ore tax imposed by the B.C. government just as our plant came into production."

American Smelting and Refining Co. has acquired 44 new claims in the Highland Valley area, three to five miles south of their Bethlehem property.

Claims are held by Minex Development Ltd., which will receive 25% of any production. Minex would be re-imbursed for pre-production costs if production is obtained.

Asarco officials say no production is planned until spring.

IN LATIN AMERICA

BOLIVIA

In an official statement outlining mining aims for 1958, the Minister of Mines said that this year will be "one of the worst in the whole Bolivian history."

After reviewing 1957's adverse mining factors (one of them—the reduction of about 10,000 tons from Bolivia's export quota), the Minister included these aims for 1958: (1) steps to capitalize the Mining Corp. of Boliva, & (2) steps to overcome a crisis resulting from the reduction of export quotas.

PERU

Cerro de Pasco Corp. is planning to build an aluminum refinery at Paracas Peninsula on land reserved by the federal government, and is now studying power potentials of the Mantaro River (estimated at 785,000 kw).

CHILE

Andes Copper Mining Co. is advancing 1,222 ft per month along its 2.5-mile haulage tunnel at El Salvador mine. This mine already has a proven reserve of 375-million tons of 1.6% copper ore and the company feels that El Salvador might become one of the world's largest copper mines.

Low copper prices have caused Compania Minera Disputada de Las Condes to cease operation at its 800 tpd flotation mill 40 miles south of Santiago.

Two Japanese firms, Nippon Mining Co. and Daichi Bussan Kaisha, are expected to purchase mining rights to an open pit copper mine near Antofagasta,

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Gasoline powered

Amazing drilling performance with revolutionary Demo Portable Rotary Hammers... a truly portable, light-weight hammer that drills by rotation and shock wave....

Suitable for horizontal or overhead drilling through materials such as reinforced concrete or masonry—using ½" to 8" detachable carbide core bits.

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Get more work for your money with these rugged performers.

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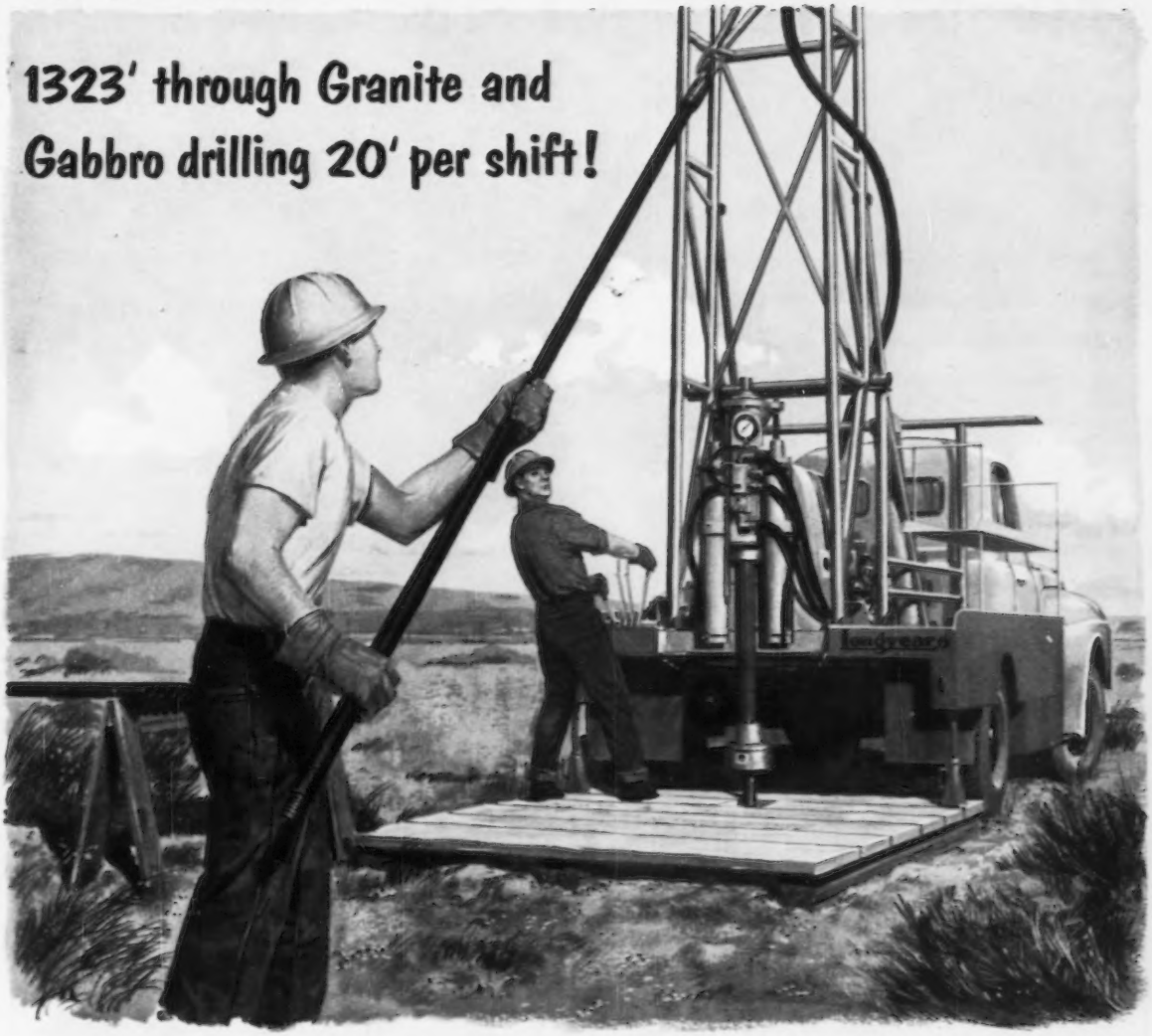
Report from the field...

1323' through Granite and Gabbro drilling 20' per shift!



Typical of Good Results With Longyear "W" Series Rods

Longyear "W" Series Rods head off trouble drillers encounter using ordinary rods. Here are four reasons why drilling costs are lower with "W" Series Rods.

1 Drill cuttings are discharged at the surface faster because the smaller space between the rod and the hole wall increases the velocity of the discharge water.

2 "W" Rods are stiffer. Increased diameter makes the drill string less flexible, more stable. Closer fit in the hole minimizes vibration, reducing gear and bearing wear in the drill.

3 Coupling openings are 22% to 88% larger than in E, A, B, and N couplings. Thus, with proper pumping facilities, an adequate water supply is more easily pumped across the face of the bit, minimizing the chances of burning due to lack of water.

4 Improved thread design makes coupling and uncoupling easier and faster.

Longyear "W" series rods are matched in advantages and performance by other components of Longyear *Coordinated Systems* for diamond drilling, including the finest drills, pumping units, diamond bits, and core barrels.

For complete information on Longyear "W" Series Rods, write for Longyear World No. 3, E. J. Longyear Company, Minneapolis 2, Minnesota

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Longyear

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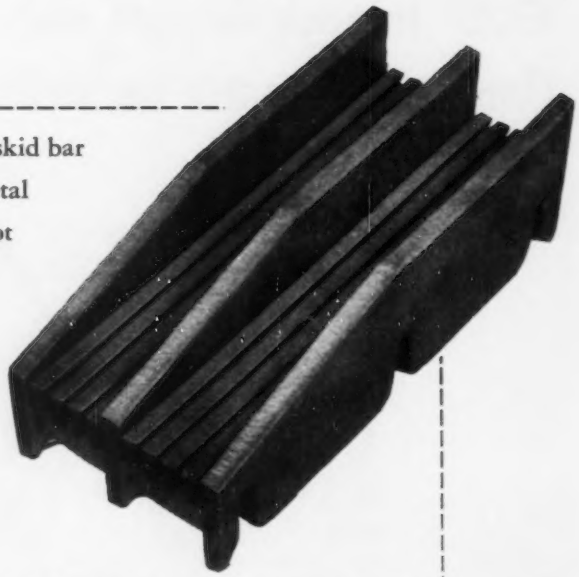
BIG BOULDERS HIT THE SKIDS

. . . *not the screen!*



There's nothing that can compare to Hendrick skid bar mounted Wedge Slot Screens for heavy-duty metal mining. The rugged skid bars protect wedge slot profiles from large or chunks . . . greatly reduce wear caused by abrasion. The C-12 profile bars have thick parallel head flanges to maintain uniformity of openings. Designed for long service life and excellent draining, C-12 bars are 12/64" wide . . . slots run the whole length of the screen. Write for more information.

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Van Gorp Belt Saver Pulleys offer today's most outstanding pulley features.

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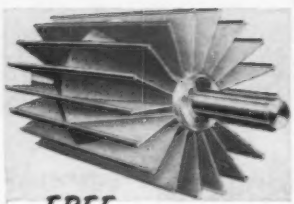

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Saves high transportation and treatment charges on your ores and concentrates.

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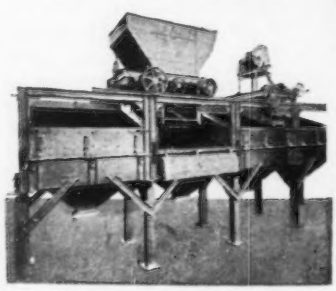

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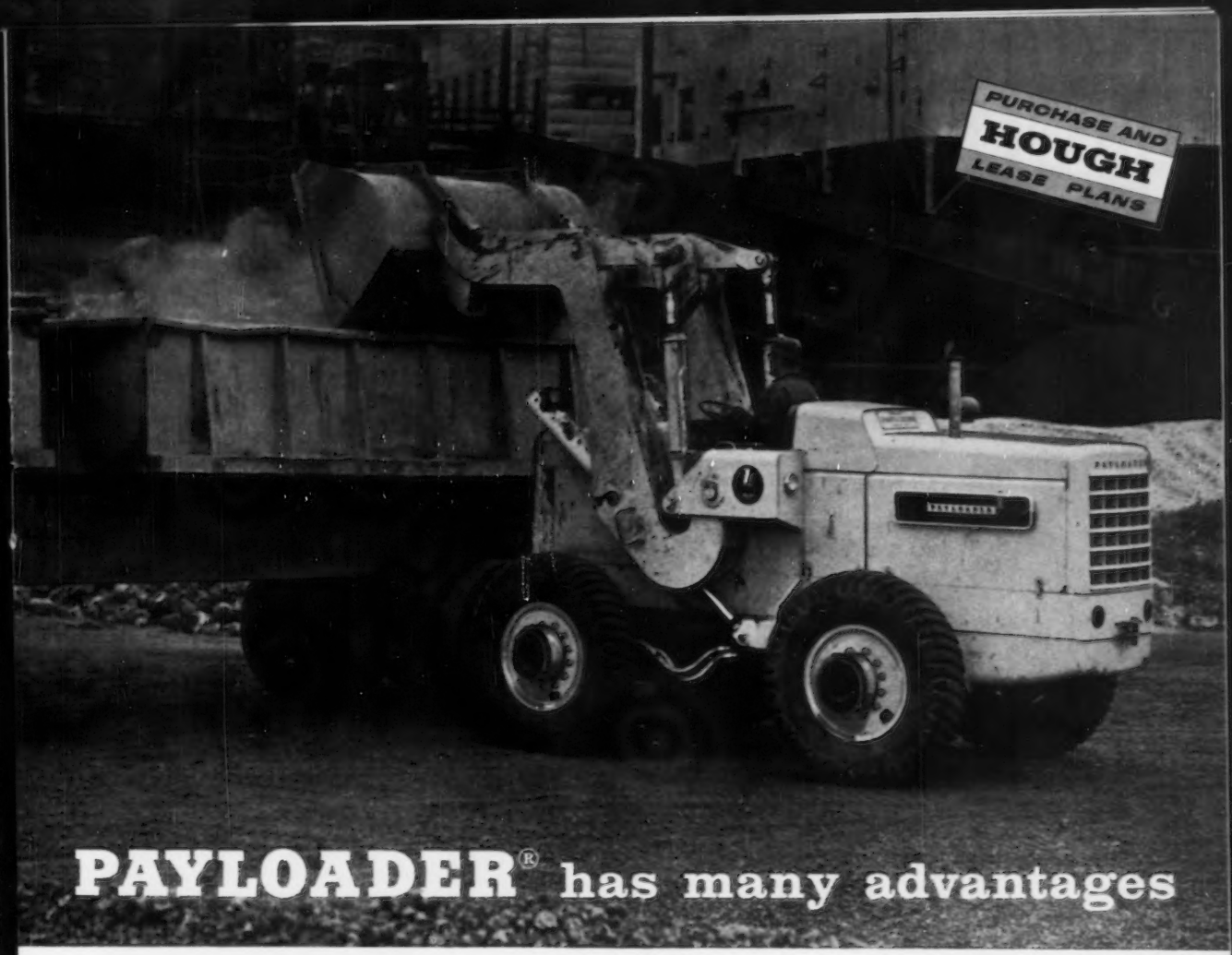

PAYLOADER® has many advantages

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Handling manganese concentrates for example (illustrated) a model HO "PAYLOADER" loads 16 Tons in 2 minutes flat. Powerful 40° pry-out tipback bucket action gets full loads quickly. No-stop power-shift transmission gives fast, easy shuttling and maneuvering for highest handling speed. Hydraulic load-shock-absorber cushions loaded bucket — reduces spillage losses, allows faster load-carry speeds.

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For scattered work, a 4-wheel-drive "PAYLOADER" moves quickly to wherever it's needed at speeds up to 24 mph.

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The big pneumatic tires don't chop up working areas and haul roads — reduce dust hazards and maintain cleaner working conditions.

Reliable on the Job

Torque-converter drive reduces drive train shock . . . planetary final drives keep torque low in all drive-train parts for longer life and lower maintenance. Power-transfer differentials insure reliable traction on all four wheels.

Versatile on the Job

4-wheel-drive "PAYLOADER" units are working underground and above-ground . . . in pits, around concentrating plants, sinters and smelters. They load trucks and cars . . . carry, windrow, spread, bulldoze . . . spot and shift railroad cars, clean out tailings ponds . . . load, move and shift machinery and supplies.

There is a Hough Distributor in your area who wants to show you what a "PAYLOADER" can do on *your* job. Ask about Hough Purchase and Lease Plans too.

Modern Materials Handling Equipment

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Send 4-wheel-drive "PAYLOADER" data.

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- ☐ Model HU (5,000 lb. carry cap.)
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3-B-6

NEW FOR YOUR CONVENIENCE...

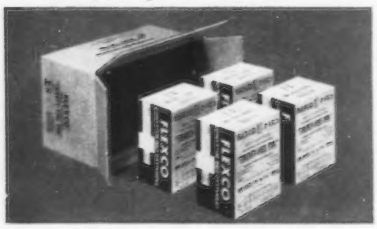
FLEXCO

"25-PAK"

TWENTY-FIVE COMPLETE SETS OF FLEXCO HD BELT FASTENERS NOW AVAILABLE IN ONE EASY-TO-HANDLE ECONOMY BULK PACKAGE

There's no need now to carry several 10-set boxes to the job—every "25-PAK" contains 25 complete sets of FLEXCO Fasteners (bottom plates, top plates, clips, nuts and bolts) . . . enough FLEXCO Fasteners to join common belt widths (for example: one "25-PAK" box, size 1½E, will join a 36" belt.) Our savings from bulk-packaging are passed on to you!

Label on each "25-PAK" box has chart indicating the number of FLEXCO HD Fasteners to use for given belt widths.



Standard shipping carton contains four "25-PAK" boxes of one size fastener. Keep a supply of "25-PAKS" on hand. Easy to store and inventory, sturdy boxes and shipping cartons have many uses.

Ask your FLEXCO distributor or write to us for additional information.

Flexible STEEL LACING COMPANY

4635 LEXINGTON ST. • CHICAGO 44, ILL.

FOR THE SPLICE OF A LIFETIME

Chile (*Continued*)

Chile. cost of developing this 110 tons of pure copper a month mine will be about $1-million and price of ore will be less for Japan than the price of ore imported from the Philippines.

IN AUSTRALIA

Loss of overseas markets and a price fall have caused the closing down of lead mines in Western Australia.

Japanese refusal to buy lead from Western Australia was a hard blow to the industry. One mine alone was exporting about 150 tons of lead concentrates to Japan every month.

Mt. Lyell Mining Co. Ltd.'s copper concentrates production rose 59% (to 24,865 tons) in the half year ended December 1957. Rise was partly due to a 23% increase in throughput and partly to. a big improvement in ore grade.

Mount Isa Mines Ltd. in Queensland, does not intend to follow the example of other leading Australian mines which have just announced production cuts of approximately 10%.

PHILIPPINES

Ample ore reserves fully justify resumption of operations at Surigao Consolidated's flooded gold mine—dewatering began in February.

Lepanto Consolidated reported a December total of 4,085 tons of concentrates from 36,510 tons milled. Estimated metal content was 2,240,630 lb copper and 3,814 oz gold, averaging 3.22% copper and 0.13 oz gold per ton.

CMA (*Continued*)

regenerant. The process is called "ion retardation" because the ion adsorbing properties of the resin slow down the flow of ions through the column. Advent of ion retardation resins is too recent to predict applications in mineral extraction, but the authors suggest investigation for metal separations.

Chelation. A chelate is a chemical which holds a metallic ion inactive in solution. The ring-like structure of the chelate gives it ability to react more selectively with certain metal ions, permitting a separation that cannot be made by other means. Possible applications of chelates include removal of gypsum scale from filter cloths; and with development of a proper resin, the separation of cobalt.

Solvent extraction. The authors reported that the use of selective organic extractants immiscible with water in the mineral processing field is only in its infancy. Applications include

PQ SILICATE AIDS TO FLOTATION

Here's how PQ silicates boost recovery of metallic oxide and non-metallic minerals (often as much as 10%).

- as gangue depressant
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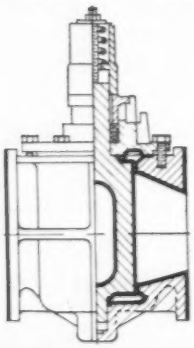
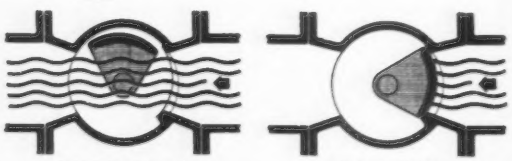


All surfaces in the flow pattern can be soft rubber lined in a DeZurik Valve, offering *complete* protection from abrasive or erosive services. There are no internal cavities where slurry material can pack.



With DeZurik's *exclusive* Eccentric Action, the plug does not *slide* against the seat. DeZurik Valves *always* close easily — regardless of the pressure inside the valve!

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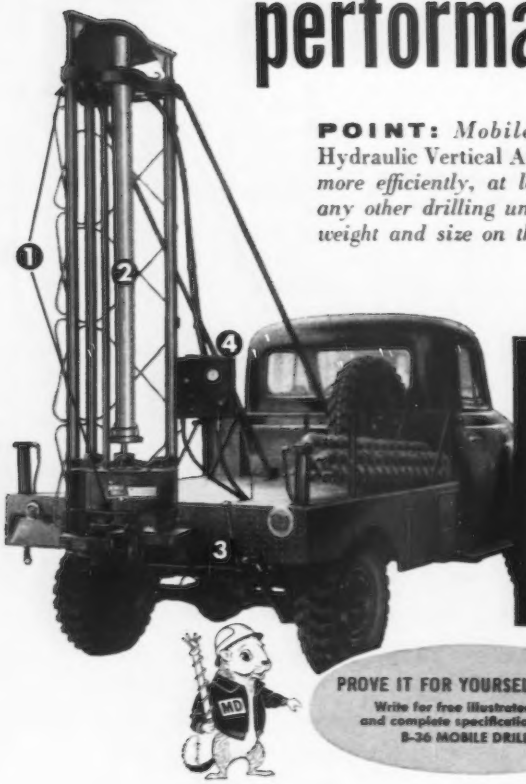

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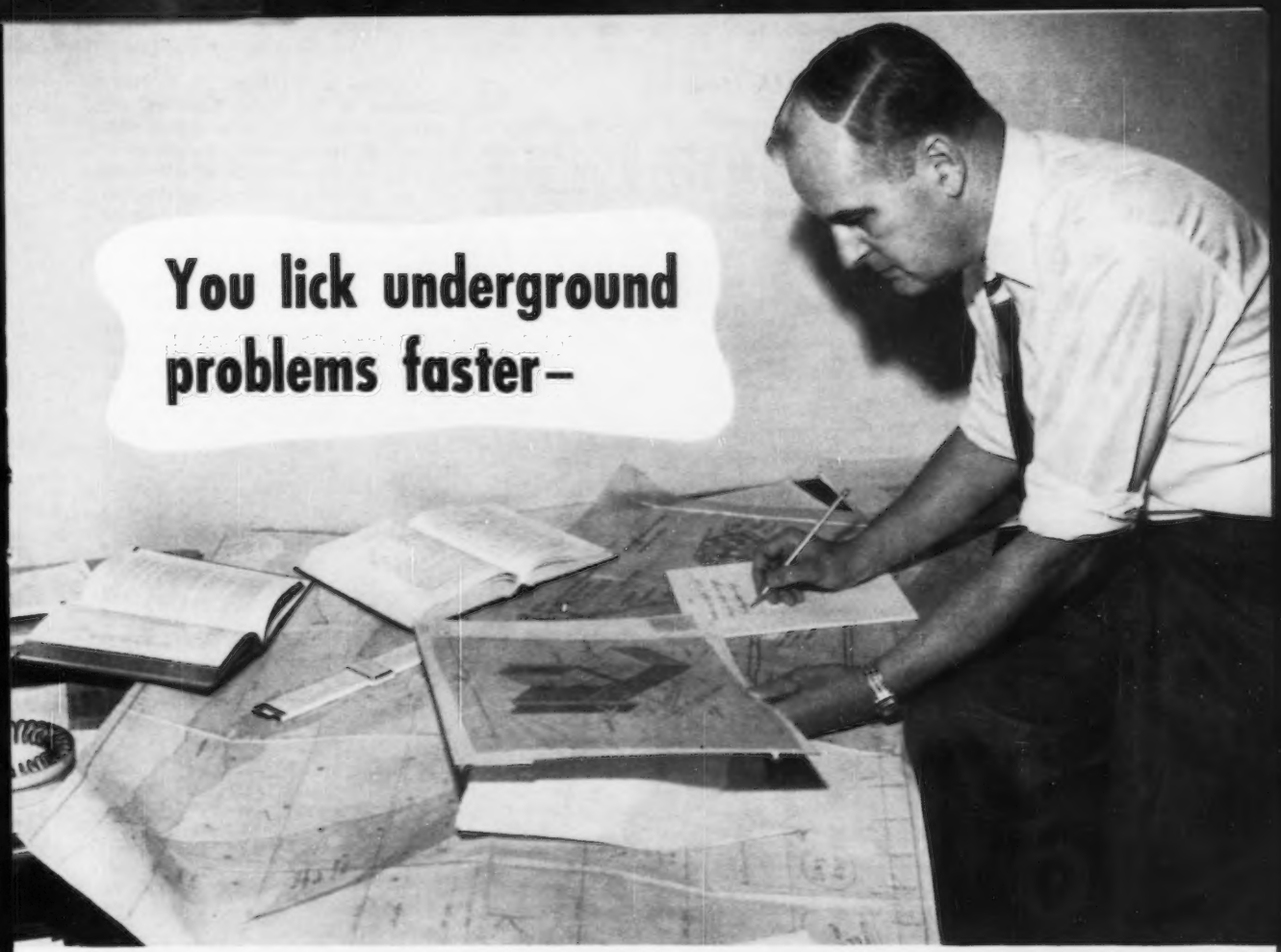

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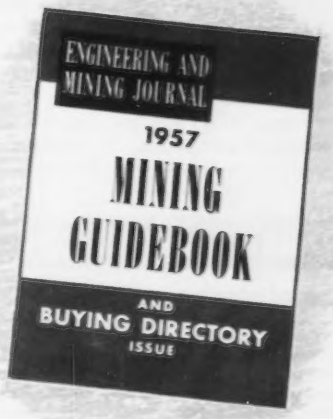

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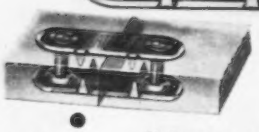

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CMA *(Continued)*

the recovery of uranium, thorium, titanium, hafnium, zirconium, columbium and tantalum from solution. Wider use of this process will come as selective solvents are developed for individual problems.

Oil Shale Advance

The Aspeco process for extraction of oil shale which has been tested in a 25-ton pilot plant in Denver by Denver Research Institute will be converted into a more advanced demonstration plant. Dr. Charles Prien, engineering chief for DRI, said that operating data from this revised pilot plant will serve as the basis for a semi-commercial plant to be erected later in Western Colorado. Research and development on the Aspeco process have led to a number of important revisions of the original process which have increased the capacity of the unit substantially.

DRI is now making economic studies of the process to evaluate capital and operating costs. The aid of several competent petroleum companies has been solicited to determine mining, transportation and refining costs and to arrive at final "cost-per-barrel" figures.

Captain A. S. Miller, U. S. Navy Director of Oil Shale Reserves, described a thoroughly "confused situation" in Government which, despite the Navy's interest in the development of an oil shale industry, adds up to only one thing—if there's to be an oil shale industry, it will be up to private industry to develop it.

Fred L. Hartley, vice president in charge of research for Union Oil Co., said that his company's plant near Grand Valley, Colo., has shown that products can be made from oil shale at prices "equal or below" costs of domestic petroleum costs.

Letters *(Continued)*

Is it possible to get a June 1, 1907 issue, Vol. LXXXIII, No. 22, of the **Engineering and Mining Journal.** An associate of mine, William F. Gordon, wrote the article, "Zinc Oxide and Zinc Lead Pigment Manufacturing." Mr. Gordon celebrated his 94th birthday Dec. 14 and is living here—still active— and lost or misplaced his copy that he has had for years.

Fred A. Lynch
6616 Lynwood Way
Highland, Calif.

The Institution of Mining and Metallurgy will hold an International Congress on Mineral Processing in London from April 6 to 9, 1960. It is proposed that the papers to be discussed should cover fundamental and applied research and development in the fields of mineral dressing, chemical processing, roasting, cyanidation, leaching and solvent extraction, but not smelting.

Enquiries should be addressed to:

The Secretary
Institution of Mining and Metallurgy
44 Portland Place
London, W. 1, England

In your January issue of E&MJ, there was an error made regarding Utahcan, Inc., in articles reporting information on mines in Washington.

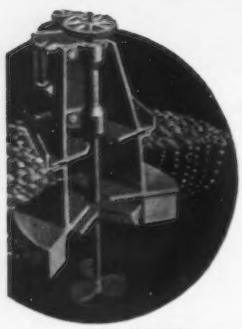
It describes our property to be about 20 to 25 miles south of the Metaline mining district. It is actually located in the Metaline mining district, five miles southwest of the Pend Oreille Mines.

Gordon Berkhaug
Utahcan, Inc.

In the article, entitled "Virginia Heavy Minerals Plant Opens" and in the heading "Metal & Thermit Corp., Hanover County, Va., Beach Sand Plant", the implication is that beach sands are being mined, with a source similar to black beach sands elsewhere. In fact, that inference cannot be avoided.

The fact is that the ore is produced from the soil and saprolite above ore-bearing pegmatites in a host rock or quartz monzonite gneiss, in typical piedmont rocks, far, far from any beach sands, modern or ancient.

Arthur Bevan
State geologist of Virginia, retired
Churchville, Va.



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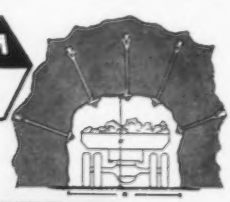

With an overall height of 66" and a width of 78", the 6-ton Ortruc presents no clearance problems in narrow drifts, and low head room conditions. Fact is, ore can be loaded in mining passages as small as 8' by 8', and still have plenty of room to spare. Every feature designed for underground hauling.

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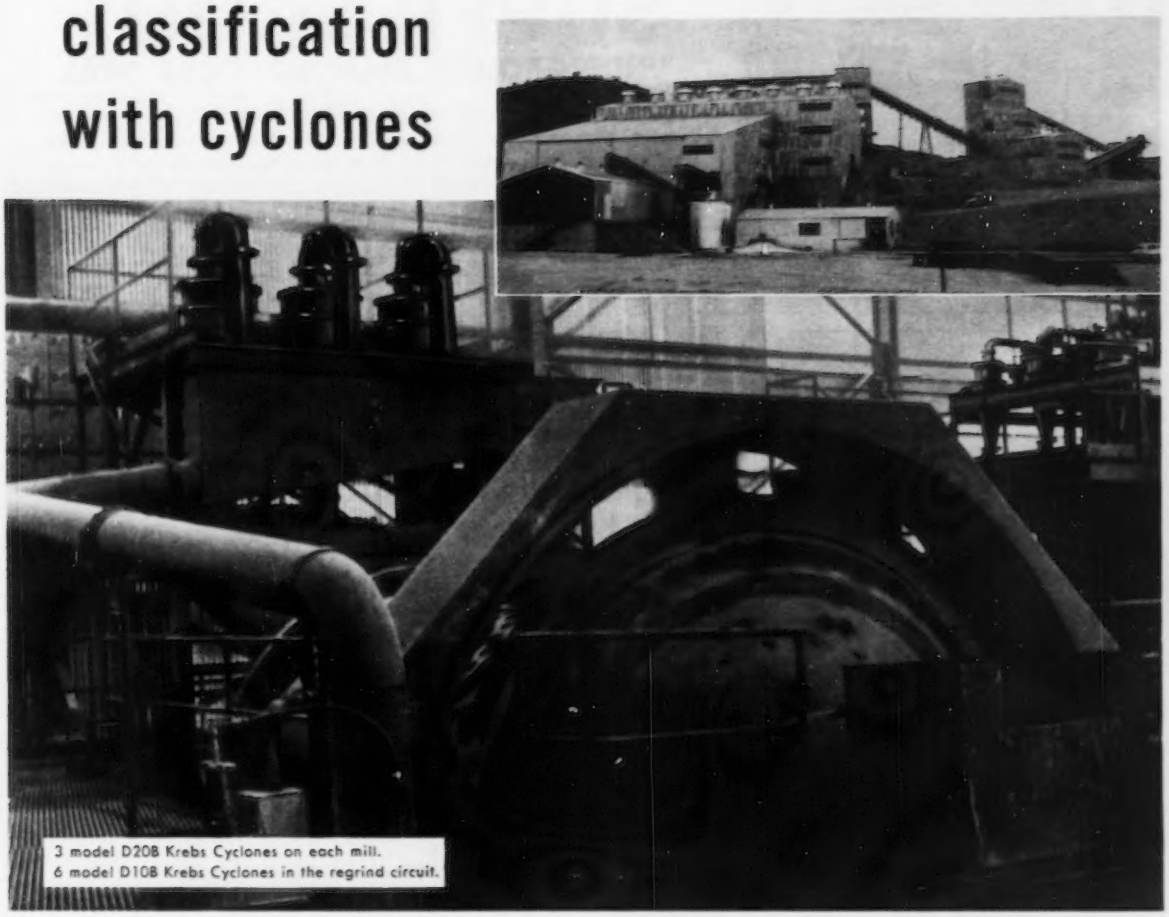
New copper concentrator does all its classification with cyclones



3 model D20B Krebs Cyclones on each mill.
6 model D10B Krebs Cyclones in the regrind circuit.

Pima Mining Company's Arizona plant, starting up in late 1956, is the first U. S. copper concentrator to classify entirely with cyclones.

Pima and nine other U. S. and foreign copper concentrators now have Krebs Cyclones for all or a major part of their tonnage. Operational costs can be substantially lower than with conventional classifiers. Capital cost is about 30%. The metallurgical advantages are usually the primary consideration . . . the flotation engineer may now have an optimum pulp density, and a selective grind of middling grains that reflects in increased concentrate grade as well as lower tailings.

Krebs Cyclone Bulletin 830 describing further cyclone techniques is available on request.

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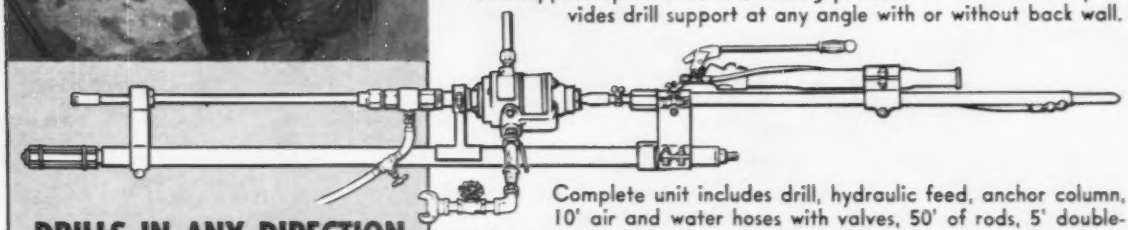

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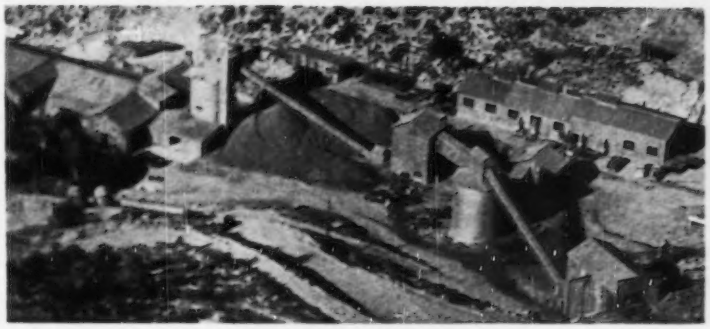

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